CARE OF THE SURGICAL PATIENT

CARE of the SURGICAL PATIENT

Jacob A Glassman, M D , F A C S , F I C S*

Assistant Clinical Professor of Surgery
University of Miami Medical School Miami Florida
Visiting Professor of Surgery at the Cook County
Post Graduate School of Medicine Chicago Illinois
Surgical Staffs of Jackson Memorial Hospital
and Mercy Hospital Miami
Mount Sinai Hospital and St Francis Hospital
Miami Beach Florida Diplomate of the
American Board of Surgery

Formerly Professor of Surgery at the Cook County
Post Graduate School of Medicine
Senior Attending Surgeon Cook County Hospital
Associate Professor of Surgery
Chicago Medical School Chicago Illinois

Raymond W McNealy, M D , F A C S , F I C S †

Late Chief Surgeon at the Wesley Memorial Hospital
President of the Staff at Cook County Hospital
Professor of Surgery at the Cook County Graduate School of Medicine
Associate Professor of Surgery at the
Northwestern University Medical School
Founder Member of the American Board of Surgery
†Deceased 1958

THE WILLIAMS & WILKINS CO Baltimore 1959

Made in the United States of America

Library of Congress
Catalog Card Number
57–7866

FOREWORD

In attempting to describe a "surgeon" in the present era of medical practice, many facets of necessity merit mention The true measure of a surgeon today is not evaluated in the surgical amphitheatre alone Technical virtuosity has been and will continue to be an important part of a surgeon's armamentarium However, given excellent technical skill and good surgical judgment, a true surgeon will ultimately be judged by the preparation and postoperative management of his patient The modern surgeon must concern himself with the physiological and biochemical as well as the anatomic and pathologic aspects of the case Meticulous attention to minute detail in the preoperative, operative and postoperative periods is a sine qua non of today s surgeon

Blind adherence to empiric pre- and postoperative routine can only result in disaster Though all cases tend to fall into broad categories with small variations each case must of necessity be individualized This concise and well organized outline for the CARE OF THE SURGICAL PATIENT' effectively establishes lines to guide the surgeon in an orderly and logical approach to each patient

The authors have succeeded in stimulating serious thought in the basic clinical sciences upon which the science and art of surgery are predicated The older and younger surgeon alike will find this book most informative and helpful

John J Farrell M D

CONTRIBUTORS

JOHN J FARRELL, M D , F A C S , Professor and Chairman of the Department of Surgery, University of Miami School of Medicine, and Chief Surgeon at Jackson Memorial Hospital, Miami, Florida

BENJAMIN M GASUL, M D , Director, Pediatric Cardiophysiology Department, Cook County Hospital, Attending Pediatric Department, Cook County Hospital, Chairman of Pediatric Department, Presbyterian Hospital, Professor of Pediatrics at Cook County Post-Graduate School of Medicine, Chicago Illinois

EGBERT HOWARD FELL, M D , F A C S , Attending Surgeon Cook County Hospital Clinical Professor of Surgery Rush U University of Illinois College of Medicine Chicago, Illinois

J P GREENHILL, M D , Professor of Gynecology, Cook County Post-Graduate School of Medicine, Attending Gynecologist at Cook County Hospital, Senior Attending Obstetrician and Gynecologist at Michael Reese Hospital, Chicago, Illinois

JEROME R HEAD, M D , Senior Attending Surgeon at Wesley Memorial Hospital, Consultant in Thoracic Surgery at Hines Veterans Administration Hospital, Attending Surgeon at Evanston Hospital, Assistant Professor of Surgery at Northwestern University Medical School, Chicago Illinois

ABRAHAM LEVINSON, M D ,* Chief of Staff of Children's Division, Cook County Hospital Senior Attending Pediatrician Mt Sinai Hospital, Chicago, Professor of Pediatrics at Northwestern University Medical School, Professor of Pediatrics at Cook County Post-Graduate School of Medicine, Chicago, Illinois

CHARLES GOLDENBERG, M D , Associate Pediatrician, Department of Pediatrics Cook County Hospital Assistant Attending Department of Pediatrics Cook County Hospital Chicago, Illinois

VINCENT J O'CONOR, M D , Professor and Chairman of Department of Urology at Northwestern University Medical School, Chairman of Urology Department at Wesley Memorial Hospital, Chicago, Illinois

WALTER J REICH, M D , Professor of Gynecology at Cook County Post Graduate School Senior Attending Gynecologist at Cook County Hospital, Chairman of Obstetrics and Gynecology at Grant Hospital Chicago Illinois

MITCHELL J NECHTOW, M D , Associate Professor of Gynecology at Cook County Post Graduate School of Medicine Associate Attending Gynecologist at Cook County Hospital Chief of Obstetrics and Gynecology at Norwegian American Hospital Chicago Illinois

CARLO SCUDERI, M D , F A C S , F I C S , Senior Attending Surgeon at Cook County Hospital Professor of Surgery at Cook County Post-Graduate School of Medicine Chicago Illinois

*Dr Abraham Levinson died 1955

INTRODUCTION

The pre- and postoperative procedures suggested in this book are applicable to various types of cases seen on a surgical service of a general hospital They are intended primarily for the guidance of surgeons, surgical residents and nurses

CARE OF THE SURGICAL PATIENT" is considerably different from an earlier book entitled ' SURGICAL CARE " New chapters on "Psychosomatic Considerations in Surgical Practice"—' Steroids in General Surgery —"The Cardiac Surgical Patient"— The Pregnant Surgical Patient"— Hospital Infections" and "Cardiac Arrest" have been included All chapters have been revised and brought up to date The chapters on Venous Thrombosis' —' Parenteral Fluids '—"Protein"— Pre- and Postoperative Infant Feeding"— 'Antibiotics in Surgery"— ' Pre- and Postoperative Orders for Cardiovascular Anomalies" and Pre- and Postoperative Orders for Adrenalectomy" have been greatly expanded Ten outstanding authorities were invited to contribute pre- and postoperative orders that they personally employ in their specialized fields

The procedures described in this book have proved invaluable in our hands, it is hoped that by making a record of our practices they may be exposed to rigid evaluation and constructive criticism

Jacob A Glassman, M D
Miami Beach, Florida
1959

This book is respectfully dedicated
to the memory of my former chief
Raymond W McNealy M D
outstanding teacher
great surgeon and
gentleman

DON'T'S TO BE KEPT IN MIND BY THE SURGICAL NURSE, INTERN AND RESIDENT

1 DON'T write down the date of injury unless you are positive the patient really had an injury
2 DON'T state any definite time as to when any condition will be well, use the terms 'In a very short time' or ' Very soon" or 'After considerable treatment '
3 DON'T use such expressions as ' Will always be," ' Will not improve ' ' Can never work,' or ' The bad result was due to careless treatment "
4 DON'T talk too much to your patients
5 DON'T lose your temper
6 DON'T argue with patients, rather side with them
7 DON'T speak ill of the treatment they have had, be it ever so ill-chosen
8 DON'T use the word "Pus' , speak of Drainage,' or "Accumulation "
9 DON'T discuss the case with anyone when dressing patients In many instances they will misinterpret your meaning
10 DON'T forget that all conversation with the patient may later confront you in court
11 DON T hold social visits—study Surgery and "Care of the Surgical Patient
12 DON T make facetious remarks, they sound very bad when repeated in court
13 DON T forget that every patient is a walking advertisement
14 DON'T forget that all patients carry their feelings on their sleeves, the reason being—they are patients

NOTES

SOME GENERAL CONSIDERATIONS ON DIET AND MEDICATION

1 **Pharmacomania is frowned upon** For example, where coughing persists deep breathing, turning patient every hour or two, or benzoin steam inhalations are favored rather than cough medicines, codeine, etc

2 **There are no P R N orders for morphine** (unless authorized by the surgeon in charge)

3 **Limit all orders for medicines to 2 or 5 days** and avoid excessive and superfluous orders

4 **Verbal orders should not be given,** except in unavoidable circumstances Sign verbal orders within 24 hours

5 **Always anticipate the patient's needs** and write adequate orders

6 **Barbiturates should be used sparingly,** especially in elderly people

7 **For pure motor restlessness, without pain, barbiturates are preferred** In no case should barbiturates be given regularly for longer than 10 days

8 **Mineral oil or plain Petrogalar** may be ordered nightly in all bed cases when patients are taking oral feedings

9 **Enemas** (S S or warm saline) every 2nd day are favored for bed patients rather than laxatives and cathartics An enema is ordered in most cases if there is no B M by the 3rd or 4th day P O A return-flow enema, (Harris-Flush) may be employed instead of a regular enema

10 **Avoid pitressin, prostigmin, pilocarpine, etc , except on specific order of surgeon**

11 A prescribed concentrated vitamin mixture in capsules may be ordered when indicated

12 **Vitamins A, B, C, D, and K should be given in adequate amounts** pre- and postoperatively to all patients who have been on a restricted diet or have suffered repeated vomiting or diarrhea

13 **ANTIBIOTIC DRUGS ARE NOT ORDERED ROUTINELY, THEY ARE EMPLOYED ONLY ON ORDER OF THE SURGEON**

Occasionally in potentially contaminated cases as in gastric resection (more especially carcinoma of the stomach), or in small or large bowel resections with bowel anastomoses, it may be helpful to use antibiotics for several days postoperatively In the preoperative preparation for bowel surgery Succinyl Sulfathiazole is given by mouth The dose is 0 25 Gm per kgm body weight per 24 hours This amount is given as one dose Stat then one-sixth of this dose is

given every 4 hours thereafter for 5 days before surgery For example a 75 kgm patient would require an initial dose of 18 75 Gms, thereafter, a dose of 3 12 Gms every 4 hrs In cases where a patient cannot tolerate a large initial dose, the drug may be administered more gradually This gradual build up is accomplished by giving 3 Gms every 4 hrs for 7-14 days preoperatively In instances where rapid sterilization of the bowel is required, Neomycin and Bacitracin may be added for 1 or more days preoperatively

Aureomycin Streptomycin Neomycin Bacitracin	May be used synergistically with sulfasuxidine for better bowel sterilization

NOTES

DON'T'S IN SURGICAL NURSING

1 DON'T ask the interns or residents for narcotics or other medication for the patient Your duty is merely to **inform** them of the patient s condition, not to suggest, "wonder about,' or 'ask for medicines' The doctor is responsible for anticipating the needs of the patient and for prescribing all the medication he considers necessary For example, it would be proper to inform the intern, "Mrs Jones has not slept for two nights because of pain" It is distinctly improper to say I was wondering if Mrs Jones could have some Nembutal tonight

2 DON'T give Demerol when it is not absolutely necessary DON'T give the patient Demerol while he is awaking from an anesthetic and is still confused It is this waking period of restlessness which is important in the patient s recovery **Narcotics at this time depress respirations and increase the likelihood of atelectasis, pneumonia and anoxemia**

3 DON T put pillows under the patient s knees after an operation Pillows compress the calf veins and predispose to phlebothrombosis and embolism Leave the foot of the bed leveled unless otherwise ordered

4 DON'T fiddle' with the needle of an intravenous set-up DON T lower the intravenous flask to determine whether the needle is in the vein This will almost invariably stop the flow by allowing the blood to run back into the needle and clot DON'T 'fiddle' with the tubing by squeezing it If you want to know whether an intravenous is running properly
   a) Look to see if the dropper is flowing in steady drops
   b) Look to see if there is an increasing swelling or firmness in the tissues around the needle If you think the set is not running properly turn the clamp off to prevent further swelling Call an intern

5 DON'T take the chart to the patient s room

6 DON'T awaken the patient to give him a sleeping pill

7 DON'T leave a very sick patient without signing out to another nurse

8 **Contact the intern on the service first on all routine matters pertaining to the patient Call the resident on the service only when the intern cannot be reached or when the matter is urgent Call the surgeon only when the resident cannot be reached**

9 See that the patient s eyes are covered and his ears plugged with cotton whenever Morphine and Scopolamine premedication are given *Light falling upon the eyes or extraneous noises reaching the* ears may cause hallucinations or disorientation

10 When the patient returns from the operating room, keep the room dark PULL THE SHADE DOWN AND TURN OUT THE LIGHTS until the patient is thoroughly awake from the anesthetic If not stimulated the patient will usually sleep quietly for some time

11 After patient awakens turn the postoperative patient from side-to-side at intervals, encourage deep breathing and movement of arms and legs This helps to prevent atelectasis, pneumonia and ultimate pulmonary embolism

12 When cevitamic acid is ordered postoperatively, it may be given in the intravenous saline or glucose solutions, (500 mg per 1000 cc) until the patient is taking nourishing liquids by mouth Vitamin C may then be given orally The patient should get about 1000 mg of Vitamin C daily postoperatively Vitamin K (Mephyton or K_1—Merck) and Vitamin B Complex (5 cc) are best given in the intravenous fluids

13 **Do not place pillows under the knees of the patient Do not allow patient to keep his thighs and knees in a position of fixed flexion The latter favors stagnation of venous circulation in the legs thereby predisposing to phlebothrombosis and embolic phenomena**

NOTES

INSTRUCTIONS FOR DAILY ROUNDS ON POSTOPERATIVE PATIENTS

ROUTINE MANAGEMENT AND QUESTIONING OF POSTOPERATIVE PATIENT

A Do not be content with just seeing the patient when making rounds Routinely check each of the following They are very important in the early recognition and treatment of complications

1 **Temperature**
2 **Blood Pressure**
3 **Pulse**
4 **Respirations**
5 **Fluid Intake and Output Chart**
6 **Bowel movements**
7 **Has the patient urinated?**
8 **How is the patient's appetite?**
9 **Has the patient passed gas?**
10 **Is the bladder distended?**
11 **Is the abdomen distended?**
12 **Are the dressings dry?**
13 **Is the wound clean?**
14 **Check fluid, electrolyte and nutritional requirements**

B **Always anticipate the patient's needs** and write adequate orders to cover them

C **Record informative progress notes daily** if there is any variation from the usual postoperative course Record every 2 days if recovery appears to be uneventful

D **When sutures are removed** record that fact in the progress notes, also state the condition of the wound at the time

E **Learn the set up** for changing dressings and do it the same way every time Improper technic invites infection

NOTES

ORDERS FOR REMOVAL OF SUTURES

The following applies to clean cases where the wound heals by primary union Retention and skin sutures are usually removed at the same time unless otherwise indicated

1 **Appendectomy**	
Through McBurney's incision	5th day P O
Through all vertical incisions	7th day P O
2 **Herniorrhaphy**	7th day P O
3 **All upper abdominal wounds**	
In thin abdomen	7th day P O
In fat abdomen	12th to 14th day P O
In carcinoma	14th to 21st day P O
4 **Thyroidectomy and facial procedures**	
Every other suture out	2nd day P O
Remaining sutures out	4th day P O
5 **Radical mastectomy**	
Every other suture out	7th day P O
Remaining sutures out	10th to 12th day P O
6 **Nephrectomy**	
Skin sutures out	7th day P O
Retention sutures out	10th day P O

7 **In abdominal wounds where deep wire or silver tension sutures are** employed the latter are removed 7 days after the skin sutures In late carcinoma cases we may remove the deep tension sutures after 2 or 3 weeks

NOTES

ORDERS FOR CATHETERIZATION

1 ROUTINE ON ALL POSTOPERATIVE CASES
   a) **Order sterile catheterization every 10 hrs, P R N** for bladder distress or distention when patient is unable to void
   b) **Order sterile catheterization every 10 hrs for residual—if** urination is frequent and in small amounts, (less than 100 cc) Continue catheterizations until residual is less than 60 cc

2 BEFORE CATHETERIZATION (Note for Nurses)
   a) **Attempt to have patient void** by application of warm dressings to perineum by running tap water in the sink or even to allow patient to stand up

3 AFTER CATHETERIZATION
   a) Administer 600,000 units penicillin daily for 3 days If urine shows many pus cells continue with antibiotics for a longer period

4 WHENEVER CATHETERIZATION IS REPEATED, OR FOLEY CATHETER LEFT INDWELLING)
   a) Start patient on Gantrisin or penicillin sulfa drug combinations
   b) Nurse should record reaction of urine (acid alkaline, neutral), to litmus or nitrazine paper daily

5 IN OPERATING ROOM—CATHETERIZE ALL FEMALE LAPAROTOMIES
   a) After fluids are started wash urethral orifice gently with sterile soap and water before inserting catheter, occasionally an indwelling Foley rubber catheter may be used throughout surgery, and for a time postoperatively

6 RECURRENT HERNIAS ARE ROUTINELY CATHETERIZED BEFORE SURGERY
   a) We try to avoid any possible injury to the urinary bladder that might have been inadvertently drawn into the operative field by previous surgery

NOTES

WATER AND ELECTROLYTES

WATER

1. Water is indispensable to life, and is constantly being expended during normal bodily activity Deprivation of water intake leads to dehydration
2. Water Balance—implies that the water intake should replace water output
3. Daily water requirement should maintain the water-balance, it should be sufficient in quantity to replace that lost through the kidneys Water intake may vary, depending upon environment, body temperature, foods digested, etc
4. Drinking of fluids is one way of supplying body water Another supply of water comes from various foods Still another source of body water is oxidation of endogenous substances

AVERAGE BODY INTAKE		AVERAGE BODY OUTPUT	
		Insensible water loss	
Water and beverages	—1200 cc	1 Lungs	— 700 cc
Water from foods 70%	—1500 cc	2 Skin	— 300 cc
		Perspiration	— 300 cc
Water of oxidation		Feces	— 200 cc
(12 cc /100 cal)	— 300 cc	Urine	—1500 cc
	3000 cc		3000 cc

The above chart indicates that under normal conditions—"water-balance should not be difficult to maintain

5. The "insensible water loss" is often lost sight of when calculating water requirements The amount of water one loses by "sweating" is usually small, but under normal living conditions is quite constant A person living in a hot climate loses more sweat and is therefore more prone to develop dehydration Similarly a patient with fever has a much greater sensible and insensible water loss than one who is afebrile A man doing heavy work on a hot day may lose an enormous amount of water—but it must be remembered too that his swe it also contains Na+ and Cl− Replacement of water alone in such instances is not sufficient—since it must also be accompanied by sodium and chloride The salt content increases as the temperature continues to rise, but as a rule sweat contains only 1/2 the sodium content of isotonic physiological saline. When water alone is used to replace sweat loss—an unfavorable drop in the isotonic pressure of the intra and extra cellular fluid takes place
6. The total amount of gastro-intestinal secretion varies, but the 24 hour volume usually remains quite constant

Digestive Secretions—Volume per 24 hours

Saliva	— 1300 cc
Gastric Juice	— 2500 cc
Bile	— 600 cc
Pancreatic Juice	— 600 cc
Intestinal Juice	— 3000 cc
	8000 cc

7 In diseases of the G-I tract, profound changes may occur in the water and electrolyte balance Excessive water losses of intestinal secretions occur in severe diarrheas, i e diarrhea of infancy bacillary and amoebic infections, also ulcerative colitis

Abnormal water losses of gastric secretions also occur as a result of vomiting from such disorders as pyloric obstruction peptic ulceration gastric carcinoma, and intestinal obstruction

8 Excessive water losses also occur during protracted drainage from fistulae, continuous gastric siphonage, profuse perspiration, extensive burns and draining wounds

9 *One of the chief functions of the kidneys is to help achieve water-balance* the kidney accomplishes this by excreting water and salts in such proportion as to maintain a constant volume and composition of the intra cellular and extra cellular body fluids

10 The kidneys by concentrating urine conserve water for the body When the concentrating ability is gone much more water is required to excrete the same amount of urinary waste products

11 **Dehydration**—(anhydremia)—affects the two general water compartments of the body

a) **Intra cellular fluids**

b) **Extra cellular fluids**

1) **Plasma**—(circulating fluid volume)

2) **Interstitial fluids**—(stationary fluid volume)

1) and 2) are separated by the capillary walls, (semipermeable membrane)

In dehydration, water is lost from the plasma and interstitial fluids by passage through the semi permeable membrane barrier or capillary walls

In starvation where the body lives on its own tissues the intracellular fluid is lost via tissue (cellular) breakdown

The first compartment affected is the plasma and interstitial fluids (extra-cellular), as the severity of dehydration increases, fluid is supplied to the body via tissue breakdown (intra-cellular)

12 **Signs and symptoms of dehydration**—vary greatly depending upon the amount and type of fluid lost, the rapidity of loss age and general nutrition of the patient

a) SYMPTOMS

1) Listlessness may go into coma

b) SIGNS

1) Skin and mucous membranes are dry

2) Tongue—dry and dull

3) Shock—not usually present in chronic dehydration

c) LABORATORY FINDINGS

1) Blood—Hemoconcentration increases blood values i e R B C W B C Protein, N P N, Hematocrit, Hemoglobin, etc Chlorides are decreased

2) Urine—is highly concentrated, values are increased, i e specific gravity, Little to no chlorides found A decreased circulating fluid volume means a decreased renal circulation Oliguria or anuria with increased N P N retention results Uremia may finally set in

d) TREATMENT OF DEHYDRATION—varies

1) Water deprivation not due to vomiting, diarrhea or excessive sweating.

(a) Treatment—aimed at replacing water and some NaCl

2) Water deprivation due to vomiting, diarrhea or excessive sweating

(a) Treatment—aimed at replacing more water, more NaCl, and also K+ Physiological Saline with or without KCl is ideal therapy

NOTES

Digestive Secretions—Volume per 24 hours

Saliva	— 1300 cc
Gastric Juice	— 2500 cc
Bile	— 600 cc
Pancreatic Juice	— 600 cc
Intestinal Juice	— 3000 cc
	8000 cc

7 In diseases of the G-I tract profound changes may occur in the water and electrolyte balance Excessive water losses of intestinal secretions occur in severe diarrheas, i e diarrhea of infancy, bacillary and amoebic infections also ulcerative colitis
Abnormal water losses of gastric secretions also occur as a result of vomiting from such disorders as pyloric obstruction, peptic ulceration, gastric carcinoma, and intestinal obstruction

8 Excessive water losses also occur during protracted drainage from fistulae continuous gastric siphonage, profuse perspiration extensive burns and draining wounds

9 One of the chief functions of the kidneys is to help achieve water-balance, the kidney accomplishes this by excreting water and salts in such proportion as to maintain a constant volume and composition of the intra-cellular and extra-cellular body fluids

10 The kidneys by concentrating urine conserve water for the body When the concentrating ability is gone much more water is required to excrete the same amount of urinary waste products

11 **Dehydration**—(anhydremia)—affects the two general water compartments of the body

a) **Intra cellular fluids**

b) **Extra cellular fluids**

1) **Plasma**—(circulating fluid volume)

2) **Interstitial fluids**—(stationary fluid volume)

1) and 2) are separated by the capillary walls (semi-permeable membrane)

In dehydration, water is lost from the plasma and interstitial fluids by passage through the semi-permeable membrane barrier or capillary walls

In starvation where the body lives on its own tissues, the intra cellular fluid is lost via tissue (cellular) breakdown

The first compartment affected is the plasma and interstitial fluids (extra-cellular) as the severity of dehydration increases fluid is supplied to the body via tissue breakdown (intra cellular)

12 ***Signs and symptoms of dehydration***—vary greatly depending upon the amount and type of fluid lost the rapidity of loss age and general nutrition of the patient

FIG I

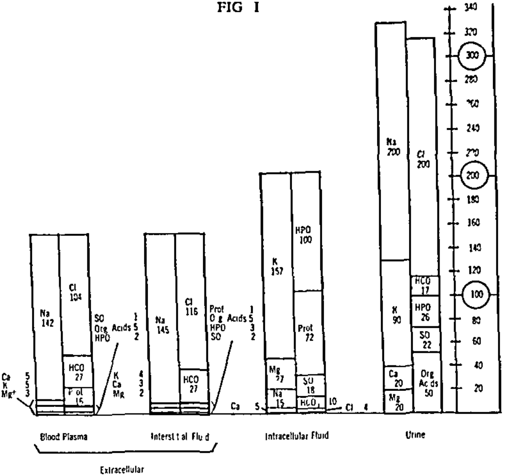


Chart illustrates comparative differences in ion content of body fluids in mEq /L

membrane barrier as well as interstitial fluid layers

5 Maintainance of volume and composition of the intracellular compartment—depends largely upon fluid intake and renal excretion both of which primarily influence the extracellular fluid compartment the intracellular fluid volume being only secondarily affected

6 **Intracellular Fluid** (Electrolyte composition) (See Chart—Fig I)

a) **Potassium** (K+), is highly concentrated within the cell, (157 mEq/L)

b) **Magnesium** (Mg++), is moderately concentrated within the cell, (26 mEq/L)

c) **Sodium** (Na+), concentration within the cell is small, (14 mEq/L)

d) It is of great significance that extracellular fluid contains little K+—and that intracellular fluid contains little Na+ In certain diseases this relationship may be seriously altered (Fig I)

KINETICS OF BODY WATER

It has been shown by studies with heavy water (deuterium oxide D_2O*) that water ingested during one day is well distributed throughout all fluid compartments of the body and that only a fraction of that water is excreted in the following 24 hours It has been estimated, that 50% of the water molecules ingested that day will eventually be excreted at the end of 10 days the remainder requiring up to 30 days Certain conditions, i e hyperthyroidism, intestinal fistulae, febrile states and climatic conditions require a rapid water turnover—and therefore the half times will vary—(i e) ingested water molecules will remain in the body a shorter time It is believed that water molecules participate continuously in all bodily functions via the plasma interstitial and intracellular fluid volumes

1 **BODY WEIGHT CHANGES**—in surgical patients usually represents fluctuations in body water Moore et al**—studying water variations in surgical patients found that the net water loss rarely exceeded 2000 cc in 24 hrs Continuation of such a water loss, without adequate water replacement, can result in shock and death in 3 days Excessive water accumulation is encountered almost as frequently as excessive dehydration In post-surgical patients an excessive water and salt accumulation can lead to hypoproteinemia by increasing plasma volume concentration of plasma protein is diminished

2 **BODY FLUID COMPARTMENTS** (See Chart—Fig I)
Body water is distributed between two major compartments
   a) **Intracellular compartment**
   b) **Extracellular compartment,**
      1) Plasma volume
      2) Interstitial fluids

These compartments are separated from each other by an actively selective cell membrane that maintains their separate chemical and physiological characteristics and functions Cellular metabolism has a constant dynamic influence upon the electrolyte concentration

A **INTRACELLULAR FLUID COMPARTMENT**

1 **Extracellular fluid volume**—measures 32% or approximately ⅓ of the total body water, (22% of total body weight)

2 **Intracellular fluid volume**—measures 66% or about ⅔ of the total body water (44% of total body weight)

3 By subtracting the extracellular fluid volume from total body water—we get intracellular fluid volume

4 **The intracellular fluid** comprises the largest fluid compartment, it represents all cellular structures separated from each other by

*Stewart, Swan and Kart—Onegerson and Stewart—Koltreider Meneely Allen Van Vorrhis and Downing.
**Moore F D., and Ball M R., "The Metabolic Response To Surgery Springfield Ill Charles C Thomas 1952.

DEFINITIONS

A MILLIEQUIVALENT

1 A Milliequivalent of a cation or base (Na+, CA++, or K+) is that amount which will neutralize a milliequivalent of an anion or acid (Cl−, CO_2 or Protein) Milliequivalent is a term denoting the neutralizing potential of acid and basic radicals—in other words it represents the physiological activity of an electrolyte

2 A milliequivalent of a monovalent ion Na+ (i e NaCl)—or Ca++, a divalent ion (i e $CaCl_2$)—will neutralize a milliequivalent of Cl− The atomic weight of an element does not determine its chemical or neutralizing activity in regulating the acid base balance One milliequivalent of Na+, (atomic wt 23) releases the same number of ions as does one milliequivalent of Cl−, (atomic wt 35) This is why values such as mg /% or Gms /100 cc of plasma fail to reveal the true capacity of acid and base radicals By employing milliequivalent values—one can readily comprehend the neutralizing potential of acid and basic radicals

B MILLIMOLS—denotes the concentration of particles in solution—(as compared with milliequivalents which implies the chemical or neutralizing potential of the particles in solution)

1 A molar solution—contains 1 mol or molecular weight of a substance per liter, (1000 millimols)

a) Normal Molar Solution of NaCl=58 Gms /1000 cc

b) Normal Physiological Solution= 9 Gms /1000 cc

C OSMOL and MILLIOSMOL

1 The unit of measure of osmotic pressure is the osmol, (1000 millimols)

2 A gram-atomic weight of electrolyte represents 1 osmol (1000 millimols)

NOTES

1) In uremia—where K+ liberation into the extracellular fluids follows cellular breakdown—the resultant hyperpotassemia may induce cardiotoxic effects, (cardiac arrest)
2) In hypopotassemic states—large amounts of Na+ may as a compensatory mechanism enter the cells and induce **metabolic alkalosis**—a condition corrected only by adequate K+ replacement

B EXTRACELLULAR FLUID COMPARTMENT

1 **PLASMA VOLUME** (See—Chart, Fig I)

a) Methods for determining plasma volume are
   1) Hematocrit
   2) Evans blue dye (T-1824)
   3) Radioactive Iodine (I^{131})
b) *Plasma volume is calculated as being 6 to 7% of total body water, and 4-5% of total body weight* Plasma volume is often expressed as cc per kgm body weight

2 **INTERSTITIAL FLUID (Electrolyte Composition)**—(See Chart, Fig I)

a) Protein content of **plasma**—16 mEq/L
b) Protein content of **interstitial fluid**—2mEq/L
c) *Capillary walls act as semi-permeable membranes (i e) they allow H_2O and electrolytes to pass through readily and remain relatively impermeable to proteins This selective specificity of the capillary walls permits the osmotic pressure of plasma proteins to maintain normal plasma volume*
d) At the **arterial end of the capillary**—where the hydrostatic pressure of the blood exceeds the colloid osmotic pressure water flows from plasma into the interstitial fluid
e) At the **venous end of the capillary**—where the unchanged osmotic pressure of the plasma protein concentration is greater than the dissipated hydrostatic pressure—water from interstitial spaces re-enters the capillary

NOTES

SODIUM CHLORIDE (NaCl)

1 Normally 5-10 Gms are excreted in the urine daily

2 1 liter of Physiological Saline Solution containing 9 Gms of NaCl, is more than adequate for a normal NaCl intake, (155 mEq/L)

3 In temperate climate and under normal conditions sodium loss via perspiration is negligible

4 Concentration of Na+ in sweat varies from 50-100 mEq/L (3 6 Gms /L), or approximately 50% below blood concentration

5 Loss of Na+ in sweat is not a means of regulating Na+ excretion, it is regarded as a by-product of temperature regulation

6 Na+ loss becomes appreciable in
   a) Hot climate
   b) Fevers
   c) Excessive muscular exercise

7 A whole day s sodium intake can be dissipated in about 6 to 8 hours by excessive sweating

8 Under normal conditions of health and environment Na+ excretion is chiefly excreted via the kidneys

9 When renal impairment is present, a lower NaCl intake is advisable in order to spare the kidneys the work of excreting it

10 Where hypoproteinemia and associated edema exist a lower NaCl intake is advisable in order not to further increase tissue edema

11 Abnormal losses of NaCl occur in vomiting, diarrhea, fistulae and during continuous stomach siphonage. These fluid secretions contain 0 5 to 0 9% NaCl and therefore approximate physiological isotonicity For every liter of secretion lost, 5 to 9 Gms of NaCl are lost NaCl must be replaced when a NaCl deficit occurs, otherwise it is relatively dispensable as far as daily metabolic requirement is concerned

Where there is no salt intake, the kidneys will usually conserve the *body s NaCl by not excreting it*

Normally when salt is taken in excess, it will be excreted by the kidneys in a manner similar to water when it is taken in excess

12 Where serious renal impairment exists and an excessive amount of NaCl is given the extra NaCl is retained in the extra-cellular spaces, leading to edema The latter is the reason for withholding salt in the management of nephritic and cardiac diseases

13 Normal urinary NaCl excretion usually implies a normal extracellular fluid volume but this alone is not a dependable measure It is more probable that a normal urinary NaCl excretion implies a normal NaCl concentration of the extracellular fluid volume

14 Addison's Disease—may show a normal urinary NaCl concentration —but low extracellular fluid volume

CONVERSION EXERCISES (mg / % TO mEq/L)

0 3% KCl in 1 liter H_2O = 3 Gms KCl or 40 mEq/L
at wt — K = 39
at wt — Cl = 35
at wt KCl = 74   3 Gms KCl = 3000 mg — 74 = 40 mEq/L in 1000 cc H_2O

---

0 9% NaCl in 1 liter H_2O = 9 Gms NaCl or 155 mEq/L
at wt — Na = 23
at wt — Cl = 35
at wt NaCl = 58   9 Gms NaCl = 9000 mg — 58 = 155 mEq/L in 1000 cc H_2O

---

1 75% Sodium Lactate 1/6 M in 1 liter H_2O = 17 5 Gms or 169 mEq/L
at wt Sod = 23
at wt Lactic Acid = 80
at wt Sod Lactate = 103   17 5 Gms = 17,500 mg — 103 = 169 mEq/L

---

0 5% NH_4Cl in 1 liter H_2O = 5 Gms NH_4Cl or 100 mEq/L
1% NH_4Cl in 1 liter H_2O = 10 Gms NH_4Cl or 200 mEq/L
2% NH_4Cl in 1 liter H_2O = 20 Gms NH_4Cl or 400 mEq/L
at wt NH_4 = 18
at wt Cl = 35
at wt NH_4Cl = 53
(0 5%) 5 Gms NH_4Cl = 5000 mg — 53 = 100 mEq/L
(1%) 10 Gms NH_4Cl = 10000 mg — 53 = 200 mEq/L
(2%) 20 Gms NH_4Cl = 20000 mg — 53 = 400 mEq/L

---

0 033% — $CaCl_2$ in 1 liter H_2O (Ringer s Sol) = 0 33 Gm or 4 4 mEq/L
at wt Ca = 40
at wt Cl = 35
at wt CaCl = 75   0 33 Gm CaCl = 330 mg — 75 + 4 4 mEq/L

NOTES

POTASSIUM METABOLISM

A Normal serum Potassium (K+) level, (16 22 mg /100 cc)—(25-5 8mEq/L)

B Normal cellular Potassium (K+) level—20 25 times higher than in serum

C The total Potassium content of the average adult body is approximately 4000 mEq/Liter, (160 Gms) of which 70 mEq/Liter, (2 7 Gms) is extracellular

D FEATURES OF POTASSIUM PHYSIOLOGY

1 Potassium is constantly being excreted by the kidneys, even during Potassium deficiency

2 Potassium excretion is enhanced by
   a) Diuresis
   b) Acidosis
   c) Alkalosis
   d) ACTH, Cortisone etc

3 The concentration of Potassium in the gastro intestinal fluids varies The gastric juice may contain variable concentrations of Potassium 5 to 40 mEq/Liter Normally about 5-10 mEq/L of Potassium is found in the feces but during diarrhea 10-20 times more Potassium may be lost

4 About 50 to 100 mEq/L of Potassium is consumed normally in our daily diet Potassium is not stored when consumed in excess, on the contrary—it is rapidly excreted

5 During starvation, disease and trauma, cellular breakdown occurs with an associated release of Potassium Where renal damage exists Potassium excretion is interfered with and the serum Potassium rises With every 1 Gm of Nitrogen breakdown, 2 7 mEq/L of Potassium is released and excreted We must remember that Hypopotassemia usually accompanies Hypoproteinemia

6 The administration of intravenous fluids during dehydration tends to lower the serum Potassium level by dilution and by increased diuresis

7 With intracellular Potassium loss there is an accompanying loss of extracellular chlorides, the loss of chloride is replaced by a rise of extracellular bicarbonate, the latter leads to eventual Alkalosis One must remember the **HYPOPOTASSEMIA ACCOMPANIES ALKALOSIS** This form of Alkalosis is best treated by adding Potassium Chloride to Physiological Saline Solution, the K+ cation is returned to the cells while the Cl− anions are returned to the extracellular compartment

E HYPERPOTASSEMIA OCCURS IN

1 Renal diseases associated with oliguria decreased Potassium excretion leads to increased K+ accumulation

15 **Nephrotic Syndrome**—urine reveals only 1 Gm /L NaCl in the presence of a normal plasma Na+

16 **Postoperative Patients**—usually show a reduced urinary excretion of NaCl despite infusions of Physiologic Saline Solution Avoid saline solution in the postoperative period unless necessary

17 **Other conditions**—in which a low NaCl excretion occurs in the presence of a severe deficit of extracellular fluid volume

a) "Diuretic recovery phase" of lower Nephron-Nephrosis
b) Nephritis, hydronephrosis, etc
c) Addison's Disease

18 **Corticotropin (ACTH)**, Cortisone and cortisone derivatives induce Na+ retention, (decreased urinary excretion) and promote greater K+ loss, (increased urinary excretion)

Adrenocortical hypersecretion (Cushing's Syndrome), being associated with increased hydrocortisone production leads to excessive Na+ and water retention and stepped up K+ loss

NOTES

e) Correction of potassium deficiency with K+ ions at times bring about a dramatic response

f) Occasionally a falling CO_2 Combining Power (improving Alkalosis) may serve as guide to K+ therapy

10 When protein breakdown occurs and the patient is in Negative Nitrogen Balance, K+ ions are also being lost, K+ can also be lost without cellular destruction

All conditions listed above are aggravated by the kidney's inability to conserve potassium So long as urine is being formed, K+ is being excreted.

H CLINICAL PICTURE OF POTASSIUM DEFICIENCY

1 Generalized weakness

2 Listlessness

3 Anorexia

4 Weakness and paralysis of legs

5 Respiratory paralysis
 a) Accessory respiratory muscles may become paralyzed, i e, intercostals and diaphragm

6 Electrocardiograph—Characteristic changes are
 a) Prolonged Q-T interval
 b) T-wave inversion
 c) S-T segment depression
 d) Prominent U waves following T waves

 E K G in almost all cases returns to normal as serum K+ reaches normal value, if K+ is stopped then E K G tracing promptly reverts back to hypopotassemic configuration

7 Serum Potassium determinations, (see normal blood values)

I TREATMENT OF POTASSIUM DEFICIENCY

1 PROPHYLACTIC

a) **The best method of handling an electrolytic deficiency is by prevention**
 1) Knowing what produces electrolytic imbalances and treating the patient expectantly, makes these disturbances less likely to occur

b) Add KCl (0 3%) to I V fluids where conditions treated are known to lead to K+ ion deficiency.

c) Add KCl (0 3%) to I V fluids whenever I V s are expected run 5 days or more regardless of the condition treated

2 ACTIVE

a) Add 0 3% KCl (3 Gms per liter or 40 mEq/L) in 5% glucose 5% Amigen or Physiological Saline Solution

b) **Rate of Administration**
 1) 60-120 drops per minute (1 liter in 4 hours)

2 Instances where the intravenous Potassium is administered either too rapidly or in excess

F CLINICAL PICTURE OF HYPERPOTASSEMIA

1 Mainly cardiac changes

a) Characteristic E K G changes are

1) *Tall T-waves with narrow bases, increasing the K+* level leads to taller T-waves

2) QRS—Complex becomes broader indicating intraventricular conduction defect

3) P-waves may disappear

4) Cardiac arrest in diastole may occur when K+ serum levels rise over 10 mEq/Liter

2 Paresthesias

3. Flaccid paralysis has been reported

G POTASSIUM LOSS (HYPOPOTASSEMIA) OCCURS IN

1 **Undernutrition** (Excessive tissue breakdown occurs with K+ liberation from the cells)

2 **Traumatic and extensive surgery**

a) Extensive segmental small or large bowel resections

3 **Burns** (Excessive tissue destruction)

4 **Diarrhea**

a) Na+ HCO_3^-, and K+ loss occurs, when a greater Na+ loss occurs an acidosis may predominate in presence of K+ deficiency

5 **Vomiting**

a) Hypertrophic pyloric stenosis, Ca of the stomach antrum and intestinal obstruction

6 **Fistulae, sinuses and ileostomies**

a) Biliary pancreatic and intestinal

7 **Intravenous fluid administration for 5 days or more without adding K+ ions to the solutions**

8 **Draining wounds**

a) Predispose to Nitrogen and potassium loss

9 **Continuous Levin tube (Gastric) suction**

a) Removes chlorides from stomach and increases CO_2 Combining Power (alkalosis)

b) Associated with Cl-ion loss is K+ loss With each 1000 cc G-I tract fluid loss 4-6 Gms of potassium are lost

c) After 3-5 days a serious amount of potassium may be lost to the body

d) Replacement with NaCl solution may aggravate the electrolytic imbalance *When Na+ ions are administered in the* face of K+ ion deficiency they enter the cell and carry with it additional water to further disturb the celullar physiology (Edema)

PLASMA ELECTROLYTE CONCENTRATIONS

A CHLORIDE ($Cl-$)

1 The normal concentration of plasma chloride ($Cl-$) is about 104 mEq/L (340 mg/100 cc)

2 Plasma chlorides alone cannot serve as a reliable indicator of extracellular fluid volume changes

Examples

a) In acidosis resulting from primary CO_2 retention (morphine or barbiturate poisoning), plasma bicarbonate increases—while plasma $Cl-$ enters the R B C 's and is excreted in the urine to make room for HCO_3 anions Here a plasma chloride of 80 mEq/L may exist in presence of a normal extracellular fluid volume

b) **In Diarrhea of Infants, Choledochal and Pancreatic Fistulae and other 'dehydration states'**—a loss high in fluid and base bicarbonates ($NaHCO_3$), often results in elevated plasma chloride co-existant with reduced extracellular fluid volume.

c) In water retention—where water intake exceeds water excretion (renal, insensible, and respiratory), a low plasma chloride may co exist with an increased extracellular fluid volume In postoperative cases during the prediuretic phase of lower nephron nephrosis and in acute nephritis—water intake usually exceeds water output and again plasma $Cl-$ will fall as the $Na+$ concentration remains normal Based on normal plasma $Na+$ levels—one may inadvertently withhold saline solution when it is sorely needed and give excess $Na+$ when it is not needed

B SODIUM ($Na+$)

1 The normal concentration of plasma sodium ($Na+$) is 138-143 mEq/L (330 mg /100 cc)

2 **Plasma Sodium**—like plasma Chlorides, cannot by itself serve as a reliable indicator of extracellular fluid volume changes (see examples cited under Plasma Chlorides —a, b and c)

3 **Determination of plasma $Na+$ and $Cl-$ levels still is our only practical means for recognizing and treating serious electrolytic imbalances.**

C POTASSIUM ($K+$)

See—Section on Potassium Metabolism

D CALCIUM ($Ca++$)

1 The normal concentration of plasma Calcium ($Ca++$) is 5 mEq/L (10 mg./100 cc.)

2 See—"Calcium ' under "Diagnosis of Specific Ion Deficiency '

E MAGNESIUM ($Mg++$)

1 The normal concentration of plasma Magnesium ($Mg++$) is 1 8 mEq/L (2 2 mg /100 cc)

2) Remember that the rate of K+ administration should not exceed the rate of K+ excretion because a rise in serum concentration, 2 times normal, has a cardiotoxic effect, (i e) heartblock, (Potassium Death)

3) Potassium dosage in children 0 26 Gm. per kilogram body weight I V in a 4 hr period

4) If patient appears anuric oliguric, or shows elevated N P N , hydrate patient well before administering KCl solution

c) When patient can tolerate liquids by mouth

1) Give 2 Gms KCl orally in some vehicle t i d. or in 'En seal form.

2) Finally, attempt to return patient to normal general diet

NOTES

2) Muscle cramps—progressing to painful cramps
3) Abdominal cramps
4) Muscle hypertonia
5) E K G , prolonged Q-T interval
6) Tetany—with carpo-pedal spasm, may terminate in convulsions
7) Hyperactive tendon reflexes
8) Muscle rigidity, (abdominal, thighs and legs)

3 MAGNESIUM—(See—"Magnesium' ,—under 'Plasma Electrolyte Content ")
a) Determination of plasma magnesium (Mg^{++}) is not easy nor is it too accurate
b) Serum magnesium is usually found elevated in uremia

NOTES

DIAGNOSIS OF SPECIFIC ION DEFICIENCY

1 **POTASSIUM**—(See—"Potassium Metabolism")
   a) Determination of plasma $K+$ concentration
   b) E K G —Relative concentration of $Na+$ to $K+$ influences Electrocardiographic tracing
   c) In dehydrated patients
      1) A normal $K+$ plasma level is possible in presence of cellular $K+$ deficit
      2) *A low $K+$ plasma level almost invariably goes with cellular $K+$ deficit*
   d) **Signs and Symptoms**
      1) **Muscular weakness**—may terminate in flaccid paralysis
      2) **Decreased tendon reflexes**
      3) **Disorientation—may terminate in coma**
      4) **Soft pulse and distant heart sounds.**
      5) **Flabby feel to musculature, (gastrocnemius and biceps)**
      6) **Vomiting—or silent ileus**
      7) **Failure to gain muscular strength** despite adequate $Na+$ and $Cl-$ fluid replacement
      8) **Failure to correct a refractory alkalosis or acidosis**—with adequate $Na+$ $Cl-$, and HCO_3 fluid replacement

2 **CALCIUM**—(See—"Calcium", under 'Plasma Electrolyte Content")
   a) Determination of plasma Calcium and Phosphorus concentrations
      1) A reciprocal relationship exists, 10 4 Ratio
   b) **Calcium deficit occurs in**
      1) Acute pancreatitis (Edematous and Hemorrhagic)
      2) Generalized peritonitis
      3) Extensive skin and subcutaneous infections
      4) Extensive burns during slough and granulation stages
      5) Repeated citrated blood transfusions
      6) Draining *fistulae, i e duodenal, jejunal and pancreatic,* actual $Ca++$ loss occurs
      7) During administration of large amounts of repair solutions —not containing the $Ca++$ ion Dilution is factor here
      8) Parathyroid gland destruction or removal Hypocalcemia is accompanied by Tetany and elevated plasma Phosphorus level
      9) Pyloric obstruction—and resulting alkalosis Ionized $Ca++$ in plasma reduced
      10) Prolonged intestinal obstructions ACTH and Cortisone therapy
   c) **Signs and Symptoms**
      1) Numbness and tingling of nose, ears, fingers and toes

tion is ultimately determined by respiratory rate and the effectiveness of the Cardio Vascular Renal Respiratory systems

2. **SODIUM ACID PHOSPHATE**—acts as a chemical buffer by changing from di-sodium phosphate (weak alkali) to mono-sodium phosphate (weak acid)

The phosphate buffers operate chiefly in the tissues The following equation indicates how di-sodium phosphate (alkaline), is converted to mono-sodium phosphate (acid) by the addition of a strong acid (HCl)

$HCl + Na\ HPO_4 \longrightarrow NaCl + NaH_2PO_4$

(Disodium phosphate) (Mono sodium phosphate)

The addition of a strong alkali (NaOH) reverses the above process

$NaOH + NaH_2HPO_4 \longrightarrow Na\ HPO_4 + H\ O$

(Mono-sodium phosphate) (Di sodium phosphate)

3. **PLASMA PROTEINS**—are capable buffers, they can take up acid or base without altering their pH Proteins are amphoteric They act as acids or bases depending on whether they are on the acid or base side of the isoelectric point Proteins therefore act as acid in base and as base in acid

At blood pH all the proteins are weak acids—and their salts act as buffers

4. **ROLE OF HEMOGLOBIN IN TRANSPORT OF CO_2**

a) CO_2 continuously diffuses from the body cells into the interstitial fluid compartment and then into the venous capillary blood

b) Though the lungs are most important eventually in eliminating CO_2 from the body it is the blood hemoglobin that immediately neutralizes the excess CO

c) One action of Hb in neutralizing CO_2 is by liberation of base, i e (K+) from Oxyhemoglobin (HbO_2) as it liberates its O_2 Liberated base (K+) combines with CO_2 (as HCO_3) to form $KHCO_3$

d) Another function of Hb as a neutralizer of CO_2 is its ability to form a loose compound **carbaminohemoglobin**, (CO_2Hb) During high CO_2 pressure in tne tissues (CO_2Hb) is readily formed while under low CO_2 pressure as in the lungs CO_2Hb quickly dissociates liberating CO_2 into the alveolae

e) By virtue of their Hb red blood cells also plan an important role in transporting CO_2

1) By means of the **"chloride shift"** and the catalytic actions of the **"carbonic anhydrase enzyme"**—the red blood cells enhance CO_2 transport in the blood and effectively dispose of it in the lungs

(Human Physiology —Best and Taylor)

ACIDOSIS-ALKALOSIS
(ACID BASE BALANCE)

The acidity or alkalinity (H^+ ion concentration) of the blood and tissues is maintained at a constant level Several very sensitive mechanisms (buffer systems) are responsible for this remarkable constancy The mechanisms which help regulate and maintain the Acid Base Balance are

A CHEMICAL
  1 Carbonic Acid and Sodium Bicarbonate
  2 Sodium Acid Phosphate
  3 *Plasma Protein and Hemoglobin (RBC)*

B RESPIRATORY

C RENAL

A **CHEMICAL**—Four known chemical buffer systems exist in the blood and tissues

1 **FREE CARBONIC ACID** (H_2CO_3) formed by the reaction of CO_2 and H_2O, becomes with its bicarbonate salt an important buffer ($BHCO_3$) in the plasma and the red blood cells When *any strong acid is added to the blood it combines with the salt of* each chemical buffer to form a weaker acid Thus, any strong acidifying effect is minimized by one or more of several chemical buffers If Hydrochloric Acid ($H+Cl-$) were added to the blood the following buffer system reactions would immediately come into operation

a) $HCl + BHCO_3 \rightleftharpoons B\,Cl + H_2CO_3$

b) $HCl + B\,HPO_4 \rightleftharpoons B\,Cl + BH_2PO_4$

c) $HCl + B$ Protein $\rightleftharpoons B\,Cl + H$ Protein

d) $HCl + B\,Hb \rightleftharpoons B\,Cl + H\,Hb$

e) $HCl + B\,Hb\,O \rightleftharpoons B\,Cl + H\,Hb\,O_2$

f) $HCl + B$ org phosphate $\rightleftharpoons B\,Cl + H$ organic phosphate

After the above reactions take place—the newly formed weaker acids continue to react with the salts of the other buffer systems until a new equilibrium is readied, namely a new pH (or $H+$ ion concentration) that is only slightly higher than before the Hydrochloric Acid ($H+Cl-$) was added

THE ALKALI RESERVE—is that portion of base which is in the form of bicarbonate This is present in the plasma in association with dissolved CO_2 ($CO_2 + H_2O \longrightarrow H_2CO_3$) in such a way that if the ratio of free CO_2 to combined CO_2 ($BHCO_3$) is 1 20, the plasma pH will remain 7 4 The free CO_2 concentra

CAUSES OF ACIDOSIS AND ALKALOSIS

A ALKALOSIS

1) Vomiting—causes
   a) Chloride (Cl^-) loss, continued HCl formation, with continued loss of (Cl^-), Alkalosis results

B ACIDOSIS

1 Diarrhea—results in loss of sodium (Na^+)
2 Fistulae—intestinal, pancreatic, and biliary fistulae, result in continued loss of sodium (Na^+), this leads to acidosis
3 Severe Dehydration
4 Surgical Shock—peripheral circulatory impairment interferes with renal circulation This prevents the elimination of acid metabolites and results in acidosis
5 Cardiac failure—results in faulty elimination of acid metabolites due to a slow moving concentrated blood Acidosis may develop
6 Starvation
7 Diabetes mellitus
8 Ketogenic diet

NOTES

B RESPIRATORY—regulation of Acid-Base Balance depends on rate of CO_2 blown off through the lungs

1 Increased respiration produces Alkalosis

a) Excess of CO_2 is blown off, this results in excess of base (B), with shift of pH to alkaline side

b) In acidosis—rapid breathing occurs This is body's attempt to rid blood of excess CO_2, (H CO_3), to compensate for low blood bicarbonate ($BHCO_3$)

2 "CO_2 **deficit"** occurs in Hyperventilation—as seen in Hysteria and after climbing to higher altitudes

3 Breathing a mixture of CO_2 and O_2 helps to restore normal CO_2 to the plasma and corrects the Alkalosis that results from CO_2 deficit

a) Decreased respiration produces Acidosis

1) CO_2 accumulates in blood, this may create an excess of H_2CO_3 with a shift of pH to the acid side

2) In alkalosis—shallow breathing occurs This is the body's attempt to increase CO_2 (H_2CO_3) in the blood, to compensate for high blood bicarbonate ($BHCO_3$)

3) 'CO_2 excess"—occurs whenever the lungs cannot eliminate CO_2 as fast as it is delivered, such as bronchial tree obstructions, alveolar pathology and pulmonary vascular diseases

C **RENAL**—The kidneys are the most important direct regulators of acid base balance The kidneys excrete an acid or alkaline urine, depending upon whether an excess of acid or base exists in the blood In infancy the kidneys are immature and do not concentrate well This fact accounts for the greater liability of infants to acidosis and alkalosis

NOTES

TREATMENT OF ACIDOSIS AND ALKALOSIS

In most cases treatment of dehydration with Physiological Saline Solution will spontaneously clear up acidosis or alkalosis In other instances such as surgical shock, Blood or Plasma dilution of viscid blood improves renal function and increases kidney clearance of excess acid or base Any existing anemia, or hypoproteinemia must also be corrected to help promote better circulation and more efficient renal excretion

Neutralizing Solutions—This type of treatment is most often employed in severe acidosis or alkalosis

A TREATMENT OF ACIDOSIS

1 Measure CO Combining Power (Based on normal of 50 60 Vol % or 28 32 mEq/L)

2 Approximate Rules for Treatment of Acidosis

Rule No 1—

For every 1 Vol % that plasma CO is less that 55 Vol % (in a 60 kgm man), apply any of the following working rules

a) 40 cc of 4% Solution of $NaHCO_3$ (I V)

b) 120 cc of 1 3% Solution of $NaHCO_3$ (I V)

c) 125 cc of 1 75% Solution of Sodium Lactate 1/6 M I V)

1) We prefer to use isotonic 1/6 Molar Sodium Lactate because the (Na) acts effectively as a buffer while the lactate radical is metabolized to lactic acid

Rule No 2—

For every 10 mEq Sodium Lactate/per kgm body wt given —Sodium ion concentration of the blood plasma increases about 14 mEq/L This corresponds to a rise in blood bicarbonate concentration of about 30 volumes of CO_2 per 100 cc blood plasma

Example

A 60 kgm man given 10 mEq Sodium Lactate 1/6 M/kgm body wt, 60 x 10 = 600/mEq Sodium Lactate This amounts to approximately 3 liters of Sodium Lactate 1/6 M—(each liter containing about 169 mEq Sodium) An improvement in the existing Sodium ion concentration of the blood should follow and be evident by a rise of about 14 mEq of Sodium

SIGNS AND SYMPTOMS OF ACIDOSIS AND ALKALOSIS

A **ALKALOSIS** (vomiting)

1. Muscular Hypertonicity
   a) Exaggerated reflexes
   b) Carpo-pedal spasm due to decreased ionic calcium in blood (Tetany)
2. Shallow—slower breathing to conserve CO_2 tension in blood
3. Plasma pH higher than 7 4 Vol %
4. CO_2 Combining Power—Increased
   Normal—
   50 60 Vol % or 28-32 mEq/L (HCO_3 in plasma)
   Alkalosis—
   70 80 Vol % or 32-37 mEq/L (HCO_3 in plasma)

B **ACIDOSIS** (diarrhea)

1. Rapid and deep breathing (air hunger) to blow off excess of CO_2
2. Plasma ph—lower than 7 4
3. CO_2 Combining Power—Decreased
   Normal—50 60 Vol % or 28-32 mEq/L (HCO_3 in plasma)
   Acidosis—20-30 Vol % or 18-13 mEq/L (HCO_3 in plasma)

NOTES

ORDERS FOR THE USE OF PARENTERAL SOLUTIONS

I SUBCUTANEOUS FLUIDS

A Hypodermoclysis

1. When veins are small or difficult to locate, hypodermic fluid administration may have to be resorted to
2. The fluids are preferably given in the losse axillary tissues or in the medial aspect of each thigh
3. The rate of flow is adjusted according to the patient's ability to absorb the solution This precaution prevents pain due to excessive distention of the tissues
4. Hyaluronidase is now being employed especially in infants and children to effect a more rapid absorption of fluids from the subcutaneous tissues (Alidase-Searle is a brand of Hyaluronidase)

II INTRAVENOUS FLUIDS (Venoclysis)

A Physiological Saline Solution*

1. This solution contains
   a) 0 9% NaCl (0 9 Gm /100 cc. or 9 Gms /1000 cc), it is isotonic with the blood
   b) Physiological Saline Solution—is usually given at a rate not exceeding 60 drops per minute, I V fluid must not be administered rapidly because it may be excreted equally as rapidly by the kidney A slower, more even administration of fluids usually results in a more efficient utilization by the body tissues

B 5% Dextrose in Distilled Water

1. Glucose administered intravenously should preferably be given in distilled water The optimum concentration of glucose in distilled water is 5% which is isotonic
   a) It is sufficient in the usual postoperative case to give 50 grams of glucose in 1 liter of distilled water (1000 cc. of 5% solution) during 6 hrs while patient is awake The indications are the prevention of acidosis and the supplying of a minimum of nourishment with the fluids
   b) Glucose solution should be given more slowly than saline solution—preferably at a rate not exceeding 60 drops per minute

      NOTE When patients have chronic cardiac or vascular changes, kidney or pulmonary disease, intravenous solutions should be given at a rate not exceeding 250 cc per hr No more than 500 cc

*Physiological Saline Solution should not be confused with Normal (Molar) Solution of Sodium Chloride which is 6 times stronger than Physiological Saline Solution

B TREATMENT OF ALKALOSIS

1. Most patients with mild alkalosis respond favorably to Physiological Saline Solution or 5% glucose in Physiological Saline Solution
2. Severe Alkalosis may be treated as follows
   a) Solution of Protein Hydrolysates (5%)
      1) Amigen
      2) Travamin
      3) Aminosol, etc
   b) CO_2 Inhalation—(30% mixture) increases CO_2 tension in blood
   c) Physiological Saline Solution
      1) Kidneys will selectively excrete the ($Na+$) and retain the ($Cl-$), especially in infants
   d) Ammonium Chloride, (2% NH_4Cl) orally will add chlorides ($Cl-$), while the ammonia radical is converted to urea by the liver
      AVOID GIVING NH_4Cl BY I V UNLESS ABSOLUTELY NECESSARY
      1) Since alkalosis is not often associated with severe circulatory collapse, no real urgency exists Therefore try 1/6 M Sodium Lactate first
   e) KCl—(0 3%) in Physiological Saline Solution, I V appears to be ideal for correction of Alkalosis The Cl-ions replace the lost chlorides while K+ ions replace the associated potassium loss
3. **Practical Considerations**
   a) It is important to remember—that electrolyte and fluid therapy is not an exact science, that ideal results are usually attained by intelligently combining careful clinical observation with accurate laboratory studies Also, it is wise—when following approximate rules to tend to under-correct rather than over-shoot the mark.
   b) The clinician must never attempt to correct in a few hours a fluid and salt imbalance that took days or weeks to develop

NOTES

6 Do not administer amino acids in the treatment of SHOCK The impaired peripheral and renal circulation interferes with the excretion of protein metabolites (hyper-amino-acidemia) and further administration of amino acids only serves to aggravate the patient's condition

7 **Where rapid preparation of a patient for surgery is required, amino acids alone cannot correct a protein deficiency Protein hydrolysates must also be supplemented by whole blood and plasma and Human Albumin Amino acids can only help to improve the circulating plasma protein deficiency, but cannot materially improve the existing generalized tissue protein deficiency. (See Hypoproteinemia)**

III PROCTOCLYSIS FLUIDS

A Physiological Saline Solution may be given in amounts of 500 to 2000 cc daily, but only in cases where indicated.

B The rectum should be emptied (by enema) before starting proctoclysis

C Proctoclysis is best run at a slow rate (60 drops per minute) 1 hr on and 1 hr off

NOTE Never start proctoclysis if the bowel has been entered or traumatized below the duodenum i e appendectomy extensive freeing of bowel adhesions, etc

D Thyroid cases may be suitable for administration of fluids by rectum postoperatively if hyperthermia is present

E Where continuous gastric suction or pyloric balance is run for more than a day the aspirated gastric material can be diluted half-and half with Physiological Saline Solution and returned by proctoclysis Material from draining T-tubes, common duct catheters or biliary fistulae may also be diluted with Physiological Saline Solution and returned by proctoclysis Solutions given by rectum should preferably be heated to 100° F.

NOTE When fluids are returned to the rectum they quickly find their way into the cecum and commonly into the terminal ileum where absorption is greatly accelerated

IV THE USE OF I-V FLUIDS IN THE OPERATING ROOM

A When foot or ankle veins are not prominent and intravenous fluids or blood are to be administered in the Operating Room, order warm wet packs from knees to toes at time patient goes to Operating Room Send patients to O R with packs in place If patient is not too apprehensive start intravenous fluids before anesthesia

B It may be necessary at times to cut down on a vein about the

should be given at one sitting

c) Vitamins, (B complex, C, and K) may be added to the dextrose or saline solutions

C **Amino acids** (Protein hydrolysates)

Amino acids are the end products of protein digestion Most amino acids can be synthesized by the body except possibly ten, the latter are called essential amino acids Protein hydrolysates are derived from casein or other animal protein by chemical hydrolysis or enzymatic digestion (Amigen is a pork pancreas digest of casein and the end product contains amino acids and small peptides) The end product (protein hydrolysate) is further supplemented with certain synthetic amino acids (i e Tryptophane) which are lost in the breakdown process The final protein nutrient is pyrogen free non toxic, and miscible with parenteral solutions i e physiological saline solution or 5% glucose in water Protein hydrolysates are employed with the hope of building tissue protein, and maintaining Nitrogen Balance

SOME PRECAUTIONS THAT MUST BE OBSERVED THROUGHOUT PROTEIN HYDROLYSATE THERAPY ARE

1 Determine patient s caloric needs, and protect the amino acids by an adequate carbohydrate (caloric) intake
2 Maintain an adequate fluid vitamin and mineral intake
3 **The ideal route for protein feeding is orally When this cannot be accomplished, parenteral administration is necessary** The following routes can be employed
   a) Intravenous
   b) Intramuscular
   c) Subcutaneous
   d) Intrasternal
4 Amino acids should be administered at a rate not more than 60 drops *per minute*, (240 *cc per hr , or* 1 liter *q* 4 *hrs*) When given rapidly, amino acids may produce undesirable effects i e nausea, vomiting dizziness flushing, cramps, backache and diarrhea The rate of administration is cut to one-half whenever acute liver pathology exists
5 Repeated I V injections of amino acids often produce local venous thrombosis It is wise initially to select the most peripheral veins Other precautions which help prevent venous thrombosis are
   a) Employ fine needles
   b) Slow rate of administration
   c) Employ lower concentrations
   d) Alternate routes of amino acid administration

FLUID BALANCE GRAPH

INTAKE AND OUTPUT RECORD

NAME ______ DOCTOR ______

DATE ______ ROOM NO ______ AGE ______

	I	O	I	O	I	O	I	O	I	O	I	O	I	O
	Blue	Red	Blue	Red	Blue	Red	Blue	Red	Blue	Red	Blue	Red	Blue	Red
3600														
3500														
3400														
3300														
3200														
3100														
3000														
2900														
2800														
2700														
2600														
2500														
2400														
2300														
2200														
2100														
2000														
1900														
1800														
1700														
1600														
1500														
1400														
1300														
1200														
1100														
1000														
900														
800														
700														
600														
500														
400														
300														
200														
100														

ankle or cubital fossa in order to administer I-V fluids through a cannula or polyethylene tube held in the vein by a ligature This is necessary when veins are collapsed or difficult to enter with a needle It is of special importance if blood is to follow physiological saline or glucose solution **An 18 gauge needle should always be employed for I V administration during surgery, this enables one to switch immediately to whole blood when such replacement becomes necessary**

NOTES

11. Hartmann's Solution* } Isotonic solution of 3 chlorides
12. Ringer's Solution** } A complete replacement solution where electrolyte loss and acidosis occur

13. Vitamins
    a) Water soluble vitamins, i e B Complex, Cevitamic Acid and Vitamin K_1 (Mephyton-Merck)

14. Special Solutions
    a) 25% Salt free, Human Albumin, (See—'Human Albumin')
    b) Plasma Expanders, i e Dextran and gelatin solutions, (See—'Plasma Expanders')

**Hartmann's Solution*—(Lactated Ringer's)—approximate pH-6 3

	% Composition	Milliequivalents per liter
NaCl	0 60	130 mEq/L — Na+
KCl	0 03	4 mEq/L — K+
$CaCl_2$	0 02	2 7 mEq/L — Ca++
Sodium Lactate	0 31	28 mEq/L — Lactate

A balanced solution for correction of dehydration accompanied by electrolyte loss and acidosis Especially useful in replacing electrolyte loss occurring in intestinal fistulae (ileal jejunal and duodenal) biliary land pancreatic fistulae

***Ringer's Solution*—Approximate pH 5

	% Composition	Milliequivalents per liter
NaCl	0 860	147 mEq/L — Na+
KCl	0 030	4 mEq/L — K+
$CaCl_2$	0 033	4 5 mEq/L — Ca++
NaHCO	0 020	156 mEq/L — Cl—

A balanced solution found useful for correction of dehydration accompanied by electrolyte loss such as occurs in gastro-intestinal fluid loss from vomiting, diarrhea and continuous aspiration with a Levin Wangensteen suction pump

NOTES

PARENTERAL FLUID ADMINISTRATION

I GENERAL INDICATIONS

A An emergency exists when deficits reach dangerous levels
1 Whole blood for hemorrhage
2 Plasma for burns
3 Water and Electrolytes for severe dehydration
4 In Acidosis and Alkalosis electrolyte equilibrium must be restored

B When the G-I tract cannot be employed for the prevention of deficits
1 Vomiting
2 Diarrhea
3 *Intestinal fistula*
4 When rest of G-I tract is essential

II SPECIFIC INDICATIONS

A Where rapid replacement of acute deficits must be accomplished, or when oral administration is too slow and ineffective
1 Whole blood for hemorrhage
2 Plasma for burns
3 I V fluids for peritonitis intestinal obstruction vomiting diarrhea and intestinal fistulae

B Where oral ingestion is impossible
1 Vomiting
2 When rest of G I tract is essential i e
a) Peritonitis
b) Intestinal obstruction
c) High intestinal fistulae (i e duodenal jejunal and biliary)
d) Immediate postoperative period

III PARENTERAL FLUIDS COMMONLY EMPLOYED

A **Hospital and Commercial Preparations**
1 Whole blood (fresh and stored)
2 Plasma (fresh and dehydrated)
3 Washed packed red blood cells
4 Physiological Saline Solution (0 9%)
5 Potassium Chloride Solution (0 3%)
6 Dextrose (glucose) Solution (5-10%)
7 Sodium Bicarbonate 1/6 M Sodium Lactate (Isotonic)
8 Protein hydrolysates (amino acids) (Amigen Aminosol Travamin etc)
9 Amigen 5% Dextrose 5% and Alcohol 5% (Mead Johnson) Has higher caloric value
10 Invert Sugar Solution 10% (Cutter) or Travert 10% (Baxter)

MIMEDIATE POSTOPERATIVE PERIOD—INFANTS

A FLUID AND ELECTROLYTE BALANCE IN INFANTS AND CHILDREN

1 It has been shown that soon after surgery the following occur:
   a) Temperature—increased
   b) Pulse rate—increased
   c) Weight—decreased
   d) Urinary findings
      1) Decrease in excretion of
         (a) Sodium (Na+)
         (b) Chloride (Cl−)
         (c) Water
      2) Increase in excretion of
         (a) Potassium (K+)
         (b) Nitrogen (N++)
         (c) Steroids

2 **Fluid and electrolyte replacement therapy** should aim at maintainance of a normal internal environment, (homeostasis) Derangements of fluid and electrolyte balance that takes place in disease must be judiciously corrected and great haste is rarely essential or desirable

3 **Fluid replacement** volume should be kept below "ceiling" values Overhydration is more serious than under hydration

4 **Sodium Chloride (NaCl)**—need not be given, its excretion is markedly reduced in the postoperative period

5 **Sugar replacement**—(Glucose or invert sugar) minimizes carbohydrate loss and enhances liver glycogen storage

6 **Amino acids**—(Protein Hydrolysate)—3 Gms /Kgm Body Wt

7 **All Replacement**—should be calculated for a 24 hour period

8 Maintainance and correction of deficits caused by losses must be considered in our calculations We select a point between 'Floor" and "Ceiling levels that best suits the individual case clinically and work along with that percentage (See—Talbot s Table I and II)

Example

Routine fluid and electrolyte replacement in an uncomplicated postoperative case A child weighing 15 lbs (7 Kgm), with surface area of 0 38 should receive (according to Talbot, et al) the following amounts of fluid and electrolytes

Utilizing Table 1 we arbitrarily select an in-between level (60%) and proceed to calculate our fluid and electrolyte requirements

Water— Ceiling Value" = 2700 cc /sq M/24 hrs
60% = 1600 cc

PRE- AND POSTOPERATIVE INFANT FEEDING

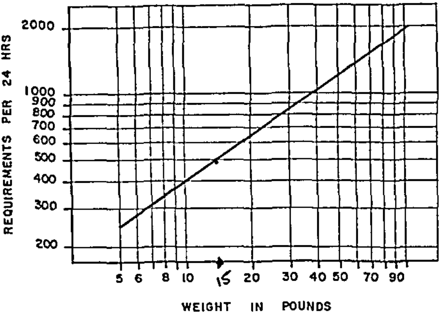
A PRINCIPLES OF PEDIATRIC FLUID AND ELECTROLYTE THERAPY

1. When electrolyte balance is markedly disturbed—institute corrective measures
2. Anticipate fluid and electrolyte loss and prophylactically treat same (Levin-Wangensteen suction, uncontrolled ileostomy and draining fistulae)
3. Avoid rapid replacement therapy
4. Avoid hypertonic saline solution—Hyponatremia, Oliguria or Anuria, unless absolutely necessary
5. Laboratory tests are useful in detecting and correcting serious electrolyte and fluid imbalances
6. When I V fluids are to be given for several days we empirically employ the following
   a) Estimate daily fluid requirement, (24 hrs)
   b) 1/3 of total fluid as physiological saline (0 45%-0 9%)
   c) 2/3 of total fluid as 5% glucose in water
7. When fluids and electrolytes are replaced in presence of oliguria or anuria—observe the following
   a) Replace only the insensible fluid loss (See lower Nephron Nephrosis)
   b) Avoid electrolytes during anuric phase give 5% and 10% glucose in water because they have a tissue-protein sparing effect
   c) Continue program until diuretic phase begins (See—lower Nephron Nephrosis)
8. Minor potassium (K+) deficits are not considered important major shifts in K+ levels resulting from losses over several days should be corrected
   a) Because of potassium toxicity—we employ
      Dosage 4 mEq per 100 cc fluid or
      2 mEq /lb body weight
   b) Give potassium solution slowly—even if depletion is marked

NOTES

FIGURE II

CHART FOR DETERMINATION OF AMOUNT OF FLUID REPLACEMENT



Graph showing parenteral fluid requirements for maintenance of young subjects in whom there are no preexisting deficits or current abnormal losses

Robert F Gross s The Surgery of Infancy and Childhood Saunders Co Phila Pa 1953 A rough guide for determining the amount of parenteral fluid required in 24 hrs The calculated amount should not be given at once—but rather at intervals of 8 or 12 hrs

THE DETERMINED AMOUNT OF DAILY FLUID REQUIREMENT SHOULD BE TEMPERED WITH SHARP OBSERVATION AND GOOD CLINICAL JUDGMENT When any serious signs of overhydration develop—**stop fluids**—and consider dehydration of patient with 50% glucose

If signs of dehydration appear, (i e) sunken eyes dry skin and tongue lethargy oliguria and concentrated urine—**increase the calculated amount of fluids**

TABLE I

HEMOSTATIC LIMITS IN PARENTERAL FLUID THERAPY**

	Floor	Ceilıng
Glucose	75 Gm /sq M/24 hrs	350 Gm /sq M/24 hrs
Sodıum (Na+)	10 mEq/sq M/24 hrs	225 mEq/sq M/24 hrs
Chlorıde (Cl—)	10 mEq/sq M/24 hrs	225 mEq/sq M/24 hrs
Potassıum (K+)	10 mEq/sq M/24 hrs	225 mEq/sq M/24 hrs
Water (H O)	900 cc /sq /M/24 hrs	2700 cc /sq M/24 hrs

The use of Table II (Body Weıght and Body Surface) as a standard reference wıll allow pedıatrıcıan and surgeon to readıly evaluate fluıd and electrolyte requırements

TABLE II

BODY WEIGHT		SURFACE AREA
Kgm	Lbs	
1	2 2	0 10
2	4 4	0 15
3	6 6	0 20
4	8 8	0 25
5	11	0 29
6	13 2	0 33
7	15 4	0 38
8	17 6	0 42
9	19 8	0 45
10	22 0	0 49
15	33	0 64
20	44	0 82
25	55	0 95
30	66	1 11
45	77	1 23
50	88	1 34

f) Estimate amount of fluid loss, i e , stomach, biliary, intestinal or colonic and evaluate electrolytic content
g) Evolve plan of therapy—based on the overall evaluation of the patient

4 **Pyloric Stenosis**
a) Findings
1) Chlorides are reduced, (HCl loss) via vomiting
2) Alkalosis results
3) Some Na+ and K+ are lost—but serum levels may not change
4) N P N may be elevated, (renal damage)
b) Treatment
1) N P O
2) Administer 0 45% Physiological Saline Solution (hypotonic)
3) Add 5% glucose—(See Table I and II)**
4) Patient is ready for surgery when
(a) Chlorides return to normal
(b) BUN and NPN are normal

5 **Paralytic Ileus, or Peritonitis**
a) Findings
1) Abdominal distention, absent peristalsis
2) Fluid and electrolyte loss into intestinal lumen and mesentery
b) Treatment
1) Awareness of internal fluid and electrolyte loss with prompt replacement therapy

6 **Uncontrolled Ileostomies**
a) Findings
1) Unlike pyloric stenosis—Sodium (Na+) loss via diarrhea
b) Treatment
1) N P O and fluid and electrolyte replacement
2) I V , 0 45% Physiological Saline Solution plus potassium (K+) (See Table I and II) **
3) In severe deficits—0 9% (isotonic), or 2% (hypertonic) saline solutions may be employed

7 **Draining Pancreatic and Biliary Fistulae**
a) Findings
1) Slight to moderate loss of chloride (Cl−), potassium, (K+) and sodium, (Na+)
2) Greater loss of bicarbonates (HCO_3)
3) Serum changes occur when deficit develops

**Talbot, N B Crawford J D and Butler A M Hemostatic limits of safe parenteral fluid therapy New England J Med 248 1100-1108 1953

1600 cc x 0 38 = 608 cc —water

Glucose—"Ceiling Value = 350 Gms /sq M/24 hrs

60% ~ 210 Gms

210 Gms x 0 38 = 80 Gms —Glucose

Sodium Chloride—"Ceiling Value" = 350 Gms /sq M/24 hrs

60% = 135 mEq

135 x 0 38 =

51 mEq/L/sq M/24 hrs Sodium Chloride

1000 cc /100% glucose—in 0 45% Saline Solution, (or 4 5 Gms , 77 5 mEq)

500 cc /100% glucose—in 0 45% Saline Solution, (or 2 25 Gms 38 7 mEq)

600 cc /10% glucose—in 0 45% Saline Solution contains

a) 600 cc water

b) 60 Gms glucose

c) 38 7 mEq NaCl

A 15 lb child would be given 600 cc of 10% glucose in 0 45% Saline Solution over a 24 hour period (according to Talbot, et al) IN THE FINAL ANALYSIS—CLINICAL JUDGMENT IS OUR MOST RELIABLE GUIDE, rule calculations can only give us approximate values that must be tempered with good clinical judgment

B SHORT TERM FLUID AND ELECTROLYTE MAINTAINANCE AND REPLACEMENT THERAPY*

1 **Maintainance Requirement**

a) Replacement of sensible and insensible water and electrolyte loss

b) Provision of nutrients i e carbohydrate, protein and vitamins

2 **Replacement Therapy**

a) Interruption of fluid and electrolyte loss should be attempted

b) Replacement of recognized deficits resulting from vomiting fistulae diarrhea sweating exudates and malfunctioning ileostomy

3 **Management**

a) Nothing by mouth during vomiting or diarrhea

b) Record Intake and Output

c) Weigh patient daily

d) Establish baseline of renal function i e BUN, NPN and Creatinine

e) Establish baseline of plasma electrolytes i e Sodium, Chloride and Potassium (See—Fig II)

*Pre and Postoperative Care in the Pediatric Surgical Patient Kiesewetter W B Year Book Publishers, Inc., 1956

METHODS OF POSTOPERATIVE INFANT FEEDING

A ORAL FEEDINGS—may be started 6 to 8 hrs postoperatively—except after major intra abdominal surgery

1 There is no substitute for oral feeding
2 Thirst for fluid and appetite for food—is ideal measure of body s demand and need
3 Infants
   a) Start with water and follow with diluted orange juice (may add sugar) After 24 hrs resume regular preoperative feedings
   b) Certain infants may require breast feedings
   c) Employ 4 hr schedule, 2-3 oz /lb body wt
4 Children
   a) Start with clear fluids broth, jello and fruit juices (may add sugar)
   b) After 24 hrs resume regular normal diet

B I V FLUID THERAPY

1 Many surgical patients in infancy and childhood do not require supplemental I V fluids, especially problems not related to G-I Tract
2 Seriously sick infants and children demand prompt, sustained and continuous parenteral fluid replacement Some of the conditions demanding I V therapy are
   a) Previous starvation vomiting and diarrhea
   b) Gastric suction
   c) Enterostomies
   d) Fistulae
3 Water retention—is a serious complication Kidneys of infants and children—are limited in their capacity to excrete excess fluids especially excess salts Postoperative temporary depression of renal function may allow extra accumulation of fluids in the tissues This will cause
   a) Peripheral edema
   b) Retarded wound healing
   c) Fatalities due to
      1) Brain edema
      2) Pulmonary edema
      3) Edema of cardiac musculature

   More children have died from 'overhydration' than under hydration
4 I V Fluids
   a) Physiological Saline Solution (0 45%)
   b) 10% Glucose—in water has a higher caloric value than 5% glucose

4) CO_2 Combining Power—lowered (acidosis)

b) **Treatment**

1) Estimate approximate losses and replace in accordance with calculated amount of fluid and electrolyte (See—Fig II)

NOTES

PLASMA PROTEINS

Proteins are the basic constituents of protoplasm They are integrated within the cell structure and function with the aid of co-ordinated enzymes Protein concerns itself with the life process and executes all the vital activities of the cell and is therefore essential to all living protoplasmic structures

Proteins contribute to the following biological processes

1. Cellular structure and metabolism
2. Enzyme formation
3. Hormone formation
4. Blood formation
   a) Hemoglobin
   b) R B C, W B C, Platelets, etc
5. Plasma proteins that influence an intravascular osmotic pressure
   a) Albumin
   b) Globulin
6. Clotting mechanism
   a) Heparin
   b) Prothrombin
   c) Fibrinogen (anti hemophilic globulins, etc)
   d) Trace Protein factors
7. Antibody formation
   a) Gamma globulins
8. Transmission of specie characteristics
   a) Cellular nuclei
      1) Chromosomes
      2) Genes

I **Normal Daily Protein Requirement**

A 1 Gm of Protein per kgm. body wt is approximately the average daily requirement for a normal person

B **Essential Amino Acids**

1 Though protein-like substances have been chemically synthesized—no one has yet synthesized a 'natural protein'

2 22 amino acids (protein building bricks) exist, they are found in animals and plants

3 **Essential amino acids**—*cannot* be synthesized by the body, they must be supplied preformed

a) They are
   1) Arginine
   2) Histidine
   3) Leucine
   4) Isoleucine
   5) Methionine
   6) Phenylalanine
   7) Threonine

c) **Blood**—unless hemorrhage exists, blood should be given slowly, **Rate**—10 cc /lb body weight (at any one time)

d) **Infants**

1) Employ 'cut down at ankle

2) Needle into scalp vein

3) Avoid superior Longitudinal Sinus and Femoral Vein

e) **Older Children**

1) Ankle and hand veins

f) **Administration of Fluids** (See—*Fig.* II)

1) I V should be run in B I D *or* T I D

2) **Infant Dosage**—10 cc /lb body wt

3) **Rate of flow**—10 drops/ minute, for continuous drip increase for short period infusion

C SUBCUTANEOUS FLUIDS

1 Physiological Saline Solution

2 5% Glucose in 0 45% Saline Solution

3 Avoid hypertonic concentrations—necrosis may be produced

4 Used occasionally in infants, rate of absorption is slow, Hyaluronidase enhances uptake Inject into back or thighs

5 Avoid hypo- and hypertonic solutions

6 Dosage—15 cc /lb body weight

D GAVAGE OR TUBE FEEDINGS

All premature and some full term infants may not be able to suck properly and should be fed by tube Insert (12F) rubber catheter and aspirate air Feeding should run in by gravity

E **PROCTOCLYSIS**—(See parenteral fluids)

1 This method is rarely used today

NOTES

II PROTEIN DIGESTION—ABSORPTION—UTILIZATION

A PROTEIN DIGESTION

1 Before proteins can be absorbed and utilized they must be broken down to their simplest unit i e the amino acids

2 Protein breakdown (hydrolysis) takes place by enzymatic action

3 Pepsinogen—secreted by the chief cells of the gastric mucosa is activated into pepsin by HCl (secreted by the parietal cells) Pepsin (gastric enzyme) in acid media (low pH), catalyzes protein into proteoses and peptones Small amino-acids may also be liberated in this breakdown process

4 Pancreatic juice—is produced by stimulation of secretin, Secretin is a hormone elaborated by the duodenal mucosa when gastric chyme enters the first portion of the duodenum Trypsinogen and Chymotrypsinogen are converted to Trypsin and Chymotrypsin by the action of Enterokinase (intestinal enzyme) Trypsin (pancreatic protein enzyme) at a higher pH catalyzes the breakdown of proteoses and peptones into simpler polypeptides and amino acids
Carboxypeptidases—found in the pancreatic juice act on polypeptides near the carboxy linkage of the molecule to break them down to free amino acids

5 Intestinal juice (succus entericus) contains aminopeptidases (enzymes that act on amino group linkage of the small molecule) to free amino acids
Dipeptidases (enzymes of succus entericus) hydrolyze certain dipeptides that aminopeptidases fail to break down

B PROTEIN ABSORPTION

1 Amino Acids are absorbed across the intestinal barrier into the portal circulation

2 Most amino acids formed by digestion are absorbed by the time the chyme reaches the colon

3 Bacteria of the colon act on the unabsorbed amino acids and produce compounds such as indole, skatole, phenol and H_2S

C PROTEIN UTILIZATION

1 Amino acids—are picked up and carried to the liver by the portal circulation small amounts enter the intestinal lymphatics and ultimately reach the general venous circulation via the thoracic duct Amino acids are so rapidly picked up by the liver and muscles that blood protein studies fail to show an appreciable elevation Later the amino acids and proteins return to the general circulation again—this time to be utilized by all cells for their own specific needs and protein synthesis Amino acids are deaminized and oxidized in

8) Tryptophane
9) Valine

b) The essential amino acids are found in the following foods

1) Eggs milk wheat cream and cheese
2) Beef fish and fowl

C NITROGEN BALANCE—exists when N intake equals or exceeds N output

1. If adequate caloric intake is met 1 Gm Protein per kgm body weight is sufficient A normal healthy person with good eating habits is usually in Nitrogen Balance
2. If caloric intake is not met with adequate amounts of carbohydrate and fat more than 1 Gm Protein per kgm body weight will be necessary That is a portion of the protein will be utilized by the body for energy metabolism instead of protein metabolism (See— Protein Utilization)
3. There is no storage of protein in the body similar to fat storage, the latter being drawn upon and metabolized during periods of deficiency Proteins of the liver and plasma are more available than other proteins for energy formation—but whenever this conversion occurs it is always associated with tissue atrophy and other signs and symptoms of protein deficiency

NOTES

III HYPOPROTEINEMIA (PROTEIN DEFICIENCY)

A Five mechanisms usually play a part in the development of protein deficiency

1) Decreased Protein Intake
2) Decreased Protein Absorption
3) Decreased Protein Synthesis
4) Increased Protein Requirement (Protein Breakdown)
5) Increased Protein Loss

1 **Decreased Protein Intake**
- a) Anorexia
- b) Sitophobia
- c) Imposed or voluntary diet restriction
- d) Starvation from any cause
- e) Vomiting

2 **Decreased Protein Absorption**
- a) Carcinoma of the stomach, pancreas or liver
- b) Vomiting, Diarrhea and Fistulae

3 **Decreased Protein Synthesis**
- a) Liver Disease, i e cirrhosis, fatty liver, jaundice
  - 1) Albumin, Fibrinogen, Heparin and Prothrombin formation are impaired
- b) Reticulo-Endothelial System
  - 1) Globulin formation impaired

4 **Increased Protein Requirement, (Protein Breakdown)**
- a) Carcinomatous growth
- b) Hyperthyroidism
- c) Pregnancy
- d) Fevers

5 **Increased Protein Loss**
- a) Hemorrhage
- b) Burns
- c) Repeated tapping of abdominal ascites
- d) Vomiting Diarrhea, and Fistulae
- e) Infections (i e) gas gangrene
- f) Neoplastic growth

B **Protein deficiency**—when allowed to continue unabated will affect all tissues of the body and ultimately manifest itself in a pattern of generalized bodily deterioration—both in appearance and function

Protein deficiency—is usually aggravated by co-existant deficiencies of K+, Na+, Vitamins and Minerals Early recognition of the signs and symptoms of protein deficiency and its immediate prophylactic correction is essential to the ultimate successful surgical result

the liver, only small amounts of amino acid Nitrogen is excreted via the kidneys The renal mechanism conserves amino acid Nitrogen when normal levels exist and excretes it when abnormally high levels develop

2 Synthesis of amino acids into specific cellular proteins occurs with the aid of special enzymes, likewise **hydrolysis** of cellular protein occurs with the aid of enzymes called cathepsins, hormones, i e as Thyroxine and tri-iodothyronine can influence the rate of these build up and breakdown processes.

3 Tissue cells to continue to remain alive must have protein enzymes that effect oxidative processes which in turn continue to further influence protein synthesis A body cell is alive by virtue of its constant state of unstable equilibrium, the latter being maintained by a continuous chain of oxidative processes

4 When the caloric intake (i e) carbohydrate and fats, is inadequate tissue proteins are mobilized and utilized for the body s energy

   a) **Catabolism**—or a state of cellular breakdown, results in *an excess of available amino acids. The amino acids be*come deaminized for other cells to utilize their breakdown products for energy production **In other words the catabilizing cells serve to maintain the health of the other body cells**

5 The body does not store an excess of amino acids If more protein is furnished the body than it requires to replace catabolized protein—the excess amino acids formed is promptly metabolized for energy production From a clinical standpoint it should be remembered that patients on diets high in protein utilize a certain portion of it as if it were carbohydrate

NOTES

4 INCREASED SUSCEPTIBILITY TO

a) **Shock**

Hypoproteinemia predisposes to decreased plasma volume

b) **Infection**

Decreased anti body formation, (gamma globulins)

c) **Intoxication**

Damaged liver cells cannot resist drug intoxication and liver disease, i e hepatitis

d) **Thrombosis and Embolism**

Delayed healing means delayed convalescence and prolonged venous stagnation

NOTES

C Specific Clinical Manifestations Associated with Hypoproteinemia

(1) Edema
  (a) Peripheral
  (b) Visceral
  (c) Wound
(2) Oliguria or Anuria
(3) Anemia
(4) Increased Susceptibility to
  (a) Shock
  (b) Infection
  (c) Intoxication
  (d) Thrombosis and Embolism

1 EDEMA

a) **Peripheral Edema**—occurs when a decrease in plasma protein causes the passage of fluid out through the arterial capillary walls This fluid accumulation occurs where hydrostatic venous pressure and tissue elasticity are greatest

b) **Visceral Edema**
  1) Pulmonary edema may occur
  2) Gastro enterostomy and entero enterostomy stomata may become obstructed
  3) Edema of bowel wall causes decreased motility and increased bowel distention

c) **Wound Edema**—predisposes to poor tissue healing, with its accompanying complications i e wound dehiscence, leakage and evisceration

2 OLIGURIA AND ANURIA

Oliguria frequently accompanies serious hypoproteinemia When the plasma volume is further reduced by dehydration and NaCl deficiency anuria may result

a) Postoperative patients with low serum protein have difficulty in clearing adequate amounts of urine Correction of protein deficiency helps to establish normal plasma volume **An increased circulating fluid volume improves renal circulation and thereby increases the urinary output**

b) *Efforts to improve the urinary output by giving Physiological Saline (NaCl and H_2O), serves only to aggravate the existing edema the serum chlorides and plasma volume are not materially increased*

3 ANEMIA—follows decreased hemoglobin formation, accurate determinations are difficult because hemoconcentration (decreased plasma volume) masks the existing anemia

c) Body tissue protein is 30 times greater than blood protein
(245 Gms P x 30 equals total tissue protein, or 7350 Gms)

3 **Rules for Nitrogen—(Deficit Determination)**

a) **Lusk Formula**

For every 1 kgm body weight lost, 30 Gms. of Nitrogen (or 187 5 Gms Protein) are lost.

Example A patient with carcinoma of the colon lost 45 lbs of weight (20 kgms) 30 Gms N x 20 equals 600 Gms N deficiency Nitrogen is 16% of Protein Therefore Gms N x 6 25 equals Gms Protein (600 x 6 25 equals 3750 Gms Protein Deficiency)

Method of Protein Replacement

1) **Orally**—a "Positive Nitrogen Balance" of 12 Gms daily can be attained
   a) 600 divided by 12 equals 50 days, required to replace lost tissue protein

2) **Parenterally**—a "Positive Nitrogen Balance" of 4 Gms daily can be attained
   a) 600 divided by 4 equals 150 days, (5 months) required to replace lost tissue protein

b) **Elman Formula**

For every 31 Gms of protein lost from the body, 1 Gm of protein came from plasma protein

Example a patient with Carcinoma of the Colon lost 45 lbs of weight (20 kgms) Total Protein determinations—5 5 Gms, Plasma Volume determination—2300 cc (5 5 Gms per 100 cc), or 23 x 5 5 equals 127 Gms P 245 minus 127 equals 118 Gms protein deficiency in plasma 118 x 30 equals 3540 Gms protein deficiency in body tissues (or 566 Gms Nitrogen)

Method of Protein Replacement

1) **Orally**—566 divided by 12 equals 47 days required to replace lost tissue protein

2) **Parenterally**—566 divided by 4 equals 141 days (over 4 months) required to replace lost tissue protein

IV DIAGNOSIS OF HYPOPROTEINEMIA (PROTEIN DEFICIENCY)

A diagnosis of protein deficiency is made on

1. History, (See III Hypoproteinemia, A, B, and C)
2. Symptoms and Signs, and
3. Plasma protein and blood volume studies

Serum albumin is normally maintained at about 4 5 Gms per 100 cc This level represents an equilibrium that serum proteins maintain with all the body tissue proteins In burns and draining fistulous tracts this equilibrium may be disturbed and a resultant protein deficiency can lead to serious tissue atrophy It is difficult to re-establish a serum protein loss since the latter takes place faster than the protein producing tissue can replace it Even though the liver is the main source of albumin and globulin production a protein deficiency will tend to seriously impair all of its important functions **Recovery from protein deficiency is usually slow and any significant serum protein rise can only take place as the liver fully recovers its capacity to produce its own plasma proteins**

A General

1. **Hypoproteinemia** only mirrors the existing general protein deficiency of the body, (Ratio 30 to 1)
2. **Albumin-fraction** is primarily decreased in hypoproteinemia
3. **Total protein study does not reveal hypoalbuminemia, because a compensatory globulin rise follows It is essential to have separate determinations of Albumin and Globulin, i e A/G Ratio**
4. **Dehydration** may cause low protein values to appear normal Fluid replacement (Dilution) will reveal the true value Blood Volume Determination is the real guide and method for accurately and effectively correcting fluid, electrolyte and protein factions

B **Clinical Methods of Determining Protein Deficiency**

1 **Normal Plasma Volume**

a) Total plasma volume equals 3500 cc

b) 50 cc plasma per kgm body wt

Example 70 kgm man x 50 cc equals 3500 cc

2 **Normal Total Protein**

a) 7 Gms per 100 cc plasma

1) Albumin—4 5 Gms

2) Globulin—2 0 Gms

3) Fibrinogen—0 5 Gm

b) There are 245 Gms of Protein in 3500 cc plasma (35 x 7 equals 245)

nal tract can tolerate a high protein, high carbohydrate, and low fat intake

3 Fortification of Diet with High Protein Foods and formulae
  a) Dried commercial protein hydrolysates, such as,
    1) Amigen (Mead Johnson)
    2) Aminoids (Arlington)
    3) Protonal (National) etc
  b) Lund's High Protein Mixture—for oral feedings during 24 hours
    1) Skim milk—3 qts (48 oz)
    2) Skim Milk powder—10 oz
    3) Amigen powder—3 oz
    4) Liver extract—1 oz
    5) Salt—½ oz (if required)
    Give 8 oz orally q 2 hrs for 24 hrs (day and night)
    For Tube Feedings—taste is no factor Increase Amigen by 3 to 7 oz otherwise same formula as above

B Active Treatment—aims at furnishing the patient enough protein to produce a Positive Nitrogen Balance

1 Oral Intake—(See Prophylactic Treatment)

2 Parenteral Intake
  a) Amino acids (Protein hydrolysates)
    1) Amigen 5%
    2) Protonal
    3) Aminosol (Abbott)
  b) Blood or Plasma Transfusion
    1) Employed in cases of acute blood or plasma loss and anemias
    2) 1000 cc of plasma furnishes 70 Gms of protein at great expense It is an impractical source of protein because it remains in the vascular bed temporarily to be hydrolized to amino acids and metabolized

3 Combined Oral-Parenteral Intake
  a) I V amino acids like plasma or blood transfusions are also an impractical source of protein for restoring large Nitrogen deficits
  b) When I V amino acids are supplemented by blood and plasma transfusions as well as a high oral protein intake a more rapid clinical improvement follows
  c) Without supplemental oral protein feedings a chronic protein deficiency cannot be corrected by amino acids alone

C METHODS OF DETERMINING BLOOD VOLUME

1 **Evans Blue Dye Test**

a) Circulating plasma value is calculated by determining the concentration of a measured dye substance injected into the circulation and allowed to mix homogeneously with the blood The dye T-1824 attaches itself to the albumin faction throughout the mixing period, only a minute portion of the dye escapes the vascular tree during the test period

b) The circulating plasma volume in most instances is considered to be the total plasma volume except in shock where a portion of the total plasma remains stagnant

2 **Radioactive Tagged Plasma Protein**

a) Plasma albumin may be tagged with radioactive iodine (I^{131})

D METHODS OF DETERMINING RED CELL VOLUME

1 Tagging red cells with radioactive chromium phosphorus or iron

2 Whole blood volume is calculated on the basis of measuring either the plasma volume or red cell mass and hematocrit

3 The following are approximate normal values for

a) **Plasma Volume, (cc /kgm body weight)**
   1) Male—43
   2) Female—42

b) **Red Cell Mass, (cc /kgm body weight)**
   1) Male—35
   2) Female—24

c) **Hematocrit, (venous)**
   1) Male—45
   2) Female—40

d) **Blood Volume, (cc /kgm body weight)**
   1) Male—78
   2) Female—66

4 A variation of 10% above and below the above figures is considered within the range of normal Obese individuals have less blood per unit body wt than lean individuals Advanced age usually reveals a reduced blood volume

V TREATMENT OF PROTEIN DEFICIENCY

A Prophylactic

In all operative cases an inevitable protein loss should be suspected and prophylactically treated by high protein intake and blood transfusions before during and after surgery

1 Oral protein feeding is superior to parenteral feeding

2 Allow patient 120 140 Gms Protein daily if gastro-intesti

tient's restlessness and apprehension with morphine sulphate gr 1/6 and repeat if necessary

NOTE The above instructions are the responsibility of the intern He should notify the resident that he has carried out all the procedures

G The transfusion service notifies the private nurse or the nurse in charge of the patient's floor of the time when transfusion will be given

H The floor nurse returns the used transfusion apparatus to the operating room or blood bank

I If it is necessary to "cut down" on a donor he should return to the hospital at a later date for examination of the wound, apply suitable dressings until the wound is healed

V METHODS OF BLOOD GROUPING*

A Microscopic Methods

1 A drop of unknown R B C suspension is added to a drop of known Group A serum, and another to a drop of Group B serum
   - a) The unknown belongs to Group A when clumping occurs with known B serum and not with A
   - b) The unknown belongs to Group B when clumping occurs with known A serum and not with B
   - c) The unknown belongs to Group AB when clumping occurs with both sera

*BLOOD GROUP TABLE

	Moss	Jansky	(International*) or Landsteiner	Agglutinogens (R.B C)	Agglutinins (Plasma)
Group	IV	I	O (Universal Donor)	O	a+b
	II	II	A	A	b
	III	III	B	B	a
	I	IV	AB	A+B	O

Figure I

   - d) Failure to clump with anti A and B sera indicates R B C belong to Group O (universal donor)

B Microscopic (Test Tube) Method

1 Each small tube (7 mm diameter) contains a drop of known serum, a drop of unknown R B C suspension, and Physiological Saline Solution

2 Centrifuge for 3 minutes (2000 r p m)

3 Set tubes in tube rack and shake

4 Positive agglutination (clumping) is present when shaking

* The Landsteiner nomenclature was adopted by Special Health Committee of the League of Nations and American Association of Immunologists There are 2 specific agglutinogens (antigens) A and B *in red blood cells* and 2 specific agglutinins (anti bodies) alpha (a) and beta (b) in the blood plasma When agglutinin (a) of plasma reacts with agglutinogen (A) *of red cells clumping* and hemolysis occur Based on the presence or absence of these blood factors 4 groups have been established See Blood Group Table

BLOOD TRANSFUSIONS

I THE MAIN INDICATIONS FOR BLOOD TRANSFUSION ARE

A Hemorrhage
B Anemias
C Shock
D Leukopenic states
E Blood clotting derangements
F Hypoprotenemia
G Antibody deficiencies

II SUITABLE BLOOD DONORS SHOULD BE OBTAINED ROUTINELY FOR THE FOLLOWING CASES

A Gall bladder and biliary tract
B Stomach and duodenum
C Small and large bowel
D Vascular i e heart and major blood vessels
E Spleen
F Chest
G Extensive open operations on the bone
H Any operation in presence of marked anemia, jaundice or any blood dyscrasia

III THE BLOOD BANK SHOULD BE GIVEN NOTICE OF SURGEON S NEEDS AS EARLY AS POSSIBLE

IV PREPARATION FOR TRANSFUSION

A Type cross match and test for Rh factor
B Notify desired number of relatives or friends of patient to appear at hospital laboratory at a specified time, to act as donors if necessary Order blood typing cross matching and blood serology on them
C Obtain compatible professional donor, if patient or family desires such or if no compatible friend or relative can be obtained
D Notify surgeon when compatible donors are available
E Notify compatible donor to be on hand at time of scheduled transfusion (preoperatively at time of operation and shortly thereafter) They should also be within reach for a few days postoperatively if possible This is especially necessary should the blood bank be unable to meet the surgeon's needs
F It is the responsibility of the intern to remain with the patient after starting the transfusion to watch for chills rash etc Immediate reactions to the donor s blood may be due to sub type, Rh factor or pyrogens STOP BLOOD TRANSFUSION IMMEDIATELY UNDER SUCH CIRCUMSTANCES Start I V physiological saline Keep patient warm If necessary, use Adrenalin I cc I V or I M It is most important to allay pa

VIII SELECTION OF DONORS

A The Blood Bank in Selecting or Rejecting a Donor is Guided by the Following Principles

1 A physician should supervise selection of donors

2 **General information required**

a) Name, age, date of birth, address, telephone number and name of donor s physician

b) Legal age, minors may be used with parents' consent

c) Minimum weight (110-120 lbs.)

3 **The Following Conditions Contraindicate Blood Donation**

a) **Pregnancy**—prohibited for 6 months after delivery

b) **Syphilis**—or History

c) **Malaria**—

1) Malarial parasites have been transmitted by transfusion 40 years after control"

2) Blood from patient with history of malaria may be used for

(a) Plasma

d) **Tuberculosis**—or History

e) **Severe Allergy**

f) **Virus Hepatitis**—or History

1) A past History of jaundice—due to cholecystic disease does not contraindicate giving blood

g) **Febrile Illnesses**—in past 6 months

h) **Frequency of Blood Donations**

1) Ten weeks rest between donations.

i) **Convulsive Seizures**

j) **Head Injuries**—associated with unconsciousness

k) **Severe Cardiac Disease**

l) **Known Narcotics**

NOTES

DONT'S IN BLOOD TRANSFUSION

1 DON'T start to work until your set up is complete and in good order
2 DON'T try to go through the skin into the vein all at once Turn on the vacuum as soon as the needle is beneath the skin—then enter vein
3 DON'T run citrate or saline solution through the tubing before inserting needle into vein
4 DON T forget to rotate the flask gently as soon as the blood flow is established, otherwise clots form
5 DON T turn vacuum on too strongly—it may suck vein wall against needle and stop flow
6 DON T inject too much novocaine The vein may be obscured from vision and palpation
7 DON T heat the blood or place hot water bottles about the bottle
8 DON T allow blood to run in too rapidly in cardio pulmonary recipients
9 DON'T employ donors listed under Conditions That Contraindicate Blood Donation'

NOTES

2 The Rh factor is an agglutinogen (antigen) present in the red blood cells of 85% of white people, (Rh+ blood) The Rh factor is absent in 15%, (Rh− blood) When Rh+ blood is transfused into a patient with Rh− blood, anti-Rh agglutinins develop in approximately 2 weeks If an Rh+ donor gives blood to an Rh− recipient, anti Rh agglutinins develop, and if a second transfusion should be given (after 2 weeks), a hemolytic reaction occurs (transfusion reaction) This mechanism will take place regardless of blood group When an Rh− mother conceives from an Rh+ father the fetus may inherit the Rh+ factor from the father If fetal red blood cells cross the placental barrier and enter the maternal circulation, anti Rh agglutinins will develop in the mother s blood If maternal plasma filters across the placental barrier into the fetal circulation its anti-Rh agglutinins will destroy the Rh+ red blood cells of the fetus A fatal anemia (Erythroblastosis Fetalis) may result REMEMBER—A HEMOLYTIC REACTION (OR TRANSFUSION REACTION) MAY FOLLOW THE FIRST TRANSFUSION IN A PREGNANT OR POST-PARTUM PATIENT IN WHOM ANTI-Rh AGGLUTININS HAVE FORMED FROM THE Rh+ FACTOR OF THE FETUS

3 **Rh Factor Determination**

a) Obtain known Rh+ cells and known Rh+ serum
   1) Rhesus monkeys have Rh+ cells (100%)
   2) Guinea pigs and rabbits have Rh− serum (100%)
   3) Anti Rh serum is made by injecting cells of Rhesus monkeys into guinea pigs or rabbits Obtain an effective dilution of anti-Rh serum

b) Add 2 drops of known anti Rh serum to 2 drops of unknown red blood cell suspension, mix and let stand Examine microscopically
   1) No clumping indicates Rh− cells
   2) Clumping (agglutination) indicates Rh+ cells

C **PYROGENIC REACTIONS**

1 IMPROPERLY PREPARED SOLUTIONS OR APPARATUS MAY CAUSE TRANSFUSION REACTIONS They are not as severe as 'incompatibility reactions' Some causes are
   a) Pyrogens in the solution
   b) Particulate matter in tubing and bottles

2 **Factors Minimizing Pyrogenic Reaction**
   a) Prompt sterilization of all solutions and equipment
   b) Rabbit pyrogen test material that fails to produce

IX REACTIONS FOLLOWING BLOOD DONATIONS

A **Approximately 10% of donors**—give reactions during or after venesection

B **Stop transfusion**—as soon as 'reaction is observed

1 Patient must remain in bed until all signs and symptoms subside

C **Continue to watch donors** for a period after venesection

D **A convulsive seizure**—during venesection may suggest **Hypocalcemia**

1 Administer 10 cc of 10% Calcium Gluconate, I V, slowly

E **Hyperventilation Syndrome**—may develop in extremely nervous donors Encourage donor to hold his breath as long as possible

X TRANSFUSION REACTIONS

Any unfavorable sequelae manifesting itself during or after blood administration—is referred to as ' transfusion reaction The incidence of reactions is approximately 0 1%

A **Hemolytic Reaction (Donor Recipient Incompatibility)**

1 When incompatible blood antigens and antibodies combine in recipient s blood—the following takes place

a) ***Red cell hemolysis***—*with release of hemoglobin into the plasma and urine*

b) **Hemoglobin**—(free)—is converted to bilirubin with resultant increase in bilirubin plasma level and jaundice

c) **Renal complications**—are

1) Lower Nephron Nephrosis (See The Renal Surgical Patient)

2) Hemoglobinuria or anuria

3) Retention of N P N Urea and Creatinine

4) Fever chills and backache

2 25-50% of Hemolytic Reactions are fatal

3 All blood specimens must be carefully identified and labeled *All matter related to blood and blood transfusions* must be properly marked labeled and classified

4 Two Smiths on the same floor or in the same ward or room should be labeled as Red Smith and Blue Smith Patients with identical names should best be separated to avoid serious error

5 **Other Factors Causing Hemolysis (Hemolytic Anemia)**

a) Injury to R B C s caused by

1) Bacterial Contamination

2) Freezing or overheating blood

B **Rh FACTOR (DONOR RECIPIENT INCOMPATIBILITY)**

1 Using Rh plus (Rh+) blood on a sensitized Rh Negative (Rh−) person

b) Burns
 1) Predominantly a plasma loss
c) Storage
 1) Liquid plasma may be stored for years
 2) Plasma irradiation with ultra-violet is not an infallible method of sterilization

B ERYTHROCYTE—CONCENTRATES—(Packed Red Blood Cells)

1 Indications
 a) Replaces hemoglobin deficit without increasing the fluid volume
 b) Packed red blood cells should be administered after the blood volume is restored to normal and only a hemoglobin deficit remains
 c) Anemias
 d) Cardio-pulmonary patients who require R B C 's—but cannot tolerate increase in blood volume

2 Administration
 a) **Donor Unit**—of red cell concentrate is the quantity of red cells obtained from 500 cc of whole blood Each donor-unit ' contributes
  1) Volume—225 cc
  2) Hemoglobin—22 Gms per 100 cc
  3) Hematocrit—71%
 b) **"Packed cells"**—when mixed with a crystalloid solution—are termed Resuspended R B C 's
 c) Washed cells —are resuspended packed cells—centrifuged with supernatant solution removed, repeated washings are often carried out—but this is not recommended, the hazard of bacterial contamination is too great

C SPECIFIC PLASMA PROTEINS

Three fractions are isolated from plasma by the alcohol-precipitation method (Cohen)*

1 **Fraction I of Cohen—(Fibrinogen and anti hemophilic Globulin)**
 a) Fraction I is available as powder
 b) When converted to liquid state—it must be utilized immediately—else it deteriorates rapidly
 c) FIBRINOGEN IS GIVEN FOR AFIBRINOGENEMIA and for severe hemorrhage in obstetrical patients
 d) Dosage 1-20 Gms —depending on
  1) Severity

*Cohen, E. Jr., et al 'The characterization of the Protein Fractions of Human Plasma Jour Clin. Invest 23 417 (1944)

pyrogenic reaction in the rabbit proves non-pyrogenic for man

c) Rubber tubing must be replaced by plastic tubing

D ALLERGIC REACTIONS

1 Usually afebrile—but fever and chills may be present

2 Usually associated with

a) Urticaria

b) Edema (angioneurotic)

c) Asthmatic breathing

3 **Antihistaminics and steroids** are indicated

a) The blood bank may add antihistamine to the blood prophylactically

E VOLUME AND SPEED OVERLOAD REACTIONS

1 Rapid infusion of blood into cardio-pulmonary patients may induce the following

a) Dyspnea

b) Rapid pulse

c) Pulmonary edema

d) Shock-like state

2 Blood Transfusion—should be given slowly to the cardio-pulmonary patient

F REACTIONS CAUSED BY BACTERIAL CONTAMINATION

1 Any change in blood developing during storage (i e) color, clots or evidence of hemolysis—should cause one to suspect bacterial contamination **The blood should be rejected**

G EMBOLIC POSSIBILITIES

1 A filter (100-200 mesh to the inch) should be part of every transfusion set to protect against embolic phenomenon resulting from particulate matter

H JAUNDICE DUE TO LOSS OF VIABILITY OF INFUSED R B C 'S

1 Storage may occasionally cause loss of R B C viability hemolysis occurs—and imparts a mild degree of jaundice immediately after transfusion

2 D D Jaundice due to

a) Hepatitis

b) Hemolysis—due to incompatibility

XI SPECIAL USES OF BLOOD FRACTIONS

A PLASMA

1 **Whole blood has its limitations**

a) **Emergencies**

1) No time for typing and cross matching

2) Plasma may be given regardless of recipient s blood group

PLASMA EXPANDERS*

There is no substitute for blood or blood plasma Blood loss should preferably be replaced with blood or plasma as soon as possible, however, in certain emergency situations, "plasma expanders" may be employed to prevent or treat shock Plasma expanding solutions possess some of the bood s physical properties—and therefore are capable of restoring and maintaining an effective circulating blood volume, by virtue of the osmotic pressure they exert, (i e) they attract interstitial fluids into the vascular tree and prevent their rapid escape into the tissues

"PLASMA EXPANDERS" are employed in the prevention and treatment of shock because they effectively restore the altered circulating dynamics back to normal See—"Shock" The altered circulatory dynamics of shock involve the following changes

1. Decreased blood flow,
2. Reduced cardiac filling,
3. Reduced cardiac output,
4. Fall in blood pressure,
5. Peripheral vasoconstriction,
6. Reduced blood flow to tissues,
7. Tissue anoxia and
8. Death ensues if treatment fails to interrupt the progressive trend of the shock-process before it becomes irreversible

Wasserman and Mayerson[1] believe dextran to be a more efficient volume expander than blood plasma The plasma volume expansion effect is maintained because dextran is not metabolized rapidly and its molecular structure slows its passage across capillary and glomerular membranes In moderate shock dextran alone will suffice however, in cases of severe shock associated with extensive blood loss, dextran is employed for its plasma volume expansion—but blood must also be administered to correct reduced oxygen-carrying capacity associated with anemia Lundy Gray and Craig have treated cases of profound shock that failed to respond to adequate blood replacement—yet responded successfully to infusions of dextran

* *Plasma Expanders'*—term has been adopted by the National Research Council

1 Wasserman K and Mayerson H S Plasma Lymph and Urine Studies after Dextran Infusions Am J of Physiol 171 218 Oct 1952

2 Lundy J S Gray H K and Craig W M Dextran in Supportive Therapy with Comments on Periston and Gelatin Arch Surg 61 55 61 1950

2) In hemophilia—0 5 Gm is equivalent to 100 cc (ml) fresh dried plasma, repeat P R N

2 **Fraction II of Cohen—(Gamma Globulin)**

a) Fraction II contains a great variety of antibodies against infectious disease

b) Gamma Globulin comes as a 16% solution

c) This fraction is used commonly against VIRUS DISEASE

d) Dosage

1) 10-20 cc (ml) depending on body weight

e) **Gamma Globulin**—is given for "Virus Hepatitis" and "AGAMMAGLOBULINEMIA' **Dosage** repeated monthly to maintain resistance to infection, (I M only)

3 **Fraction V of Cohen (Albumin)**

a) Albumin comes as 25% solution, (25 cc (ml) of 25% albumin is obtained from 500 cc (ml) blood

b) 25% (salt poor) Human Albumin—is hyperosmotic, 100 cc (ml) is equivalent to 500 cc plasma, (i e) 100 cc attracts 400 cc (ml) water from interstitial fluids into the vascular tree

c) In burn, traumatic or hemorrhagic shock—it is best to give liquid plasma or blood, or 25 cc of 25% Albumin (salt poor) added to 100-200 cc solution 25 cc of 25% Albumin pulls approximately 3½ x its volume into the circulation in 15 minutes

d) Albumin may remain stable for 5 years

e) **HUMAN SERUM ALBUMIN (SALT POOR) IS INDICATED IN THE FOLLOWING INSTANCES**

1) **Shock**—traumatic burn, hemorrhagic etc

2) **Hypoproteinemia**—(protein deficiency)

3) **Cirrhosis of Liver**—With or without ascites

4) **Nephrotic Syndrome**—associated with Albumin loss replaces Albumin and invokes diuresis

Plasma Expanders in use are

1. 60% gelatin
2. Plasma gelatin
3. Oxypolygel
4. Polyvinyl pyrolidone, (PVP)
5. **DEXTRAN,** (Gentran-Baxter)

C INDICATIONS

There are no contraindications to the use of plasma expanders in emergency situations—WHEN AND IF

1. Blood and plasma are not available
2. Safe amounts of plasma expanders should be administered, 1 liter usually, no more than 2 liters in special instances
3. Before administering plasma expanders the blood should be typed and cross matched because gelatins will subsequently interfere with the accuracy of these blood determinations

D DOSAGE

Administered intravenously only, 1 or 2 units (500-1000 cc) is the usual dose, but 3 or 4 units may be employed in special instances

Rate of Administration—15 to 50 cc per minute, 1 unit should require about 30 minutes to run in

E TOXICITY AND PRECAUTIONS

1. In patients with cardiac and renal disease, the hazards of congestive heart failure, pulmonary edema and renal shutdown are ever present
2. Urticarial reactions
3. Hypotension
4. Wheezing (asthmatic breathing)
5. Nausea and vomiting

NOTE

1) Where manifestations of adverse systemic reaction develop stop dextran immediately
2) Signs and symptoms of adverse reaction should immediately be treated with parenteral Adrenalin (0 5-1 0 cc 1 1000) and antihistamines

A PHARMACOLOGY

1. Dextran—is a water dispersible, high molecular weight glucose polysaccharide, $(C_6H_{10}O_5)n$ It is produced by Leuconostoc-mesenteroides enzymes acting upon a solution of sucrose In crude form, dextran has a molecular weight of approximately seven million and is unsuitable for clinical use unless it is further refined by acid hydrolysis and fractionation Commercial preparations (i e) Gentran (Dextran)* are further purified and the molecular weight controlled at about 75,000, this approximates the weight of serum albumin

   Gropper, et al [3] and Helman and Becker[4] studied dextran labeled with C^{14}, and discovered

   1) 30-50% of dextran and its metabolites are excreted in first 24 hours
   2) 60% of the total urinary excretion occurs during this period, this raises specific gravity of urine
   3) Over a 10 day period—72% of dextran and its metabolites are excreted in the urine, 21% in the breath and 2% in the feces
   4) Gray and Highland[5] found that a portion of non-excreted dextran is converted to glucose, the latter enters the carbohydrate pool and is ultimately converted to carbohydrate, protein and fat
   5) Dextran had no harmful effect upon hepatic or renal function

B IDEAL PLASMA EXPANDERS—should possess the following characteristics

1. 50% of the infusion should be retained by the body after 24 hours
2. Osmotic pressure should be satisfactory
3. Sedimentation rate should be satisfactory
4. The infusion should not remain in the tissues too long
5. The infusion should be
   a) Non toxic
   b) Non pyrogenic
   c) Non-allergic
   d) Easily sterilized
   e) Easily stored
   f) Easily manufactured

*Baxter Laboratories state that (Gentran) — 6% dextran in saline does not affect the blood—and preliminary blood typing cross matching and Rh factor determinations are not required

3 Gropper A.L Roisz, L.G and Amspader W H Plasma Expanders Internat Abstr of Surg. 95 542 Dec 1952

4 Hellman L. and Becker D A Study of C^{14} labeled Plasma Substitutes Progress Report, Feb 1 April 30 1952

5 Gray I and Highland G P Metabolism of Plasma Expanders studied with Carbon[14]—Labeled Dextran presented at Am Chem Soc 122nd meeting Atlantic City N.J Sept. 18 1952.

c) Danger to his life, job or business are serious considerations

3 **The surgeon must be aware of the patient's fears and questions—and should provide the answers and allay his fears**

4 **Practical Considerations that Cannot be Overlooked**

a) Discuss insurance coverage and other extraneous medical costs

b) Surgical fee and means of paying same should be discussed in advance

c) Should the patient and family be told he has cancer?

d) If diagnosis is cancer—what must patient know?

1) What is the prognosis (longevity)?

2) Will colostomy be necessary?

3) Will patient continue to hold his job?

5 **Prepare Patient in Advance of Surgery**

a) Explain difference between hospital and home living

b) Explain loss of personal privacy

c) Explain need to overcome repugnance to bed pans urinals and hospital odors

d) Explain about catheters and drains

e) Explain about I V fluids and blood transfusions, make clear how such procedures improve the patient and speed up recovery

f) Explain routine stop over in Recovery Room, explain its advantages in immediate postoperative period

g) Discuss food likes inquire into food and drug allergies Kosher food may be a serious consideration in some patients

h) Explain duration of stay in hospital, give approximate number of days

i) Explain how certain bodily defects after surgery may or may not require a re-evaluation of one s life program

j) In special instances—special anxieties usually develop and much can be done to prevent or allay them

For example

1) Ear surgery—explain fear of deafness

2) Eye surgery—explain fear of blindness

3) Laryngeal surgery—explain fear of asphyxiation and speech loss

4) Lung and heart surgery—explain fear of sudden death

5) Intestinal surgery—explain fear of obstruction constipation and painful adhesions

6) Genito urinary surgery—explain fear of loss of sexual potency masculinity and sex appeal

7) Stomach surgery—explain fear of loss of eating enjoyment

8) Rectal surgery—explain fear of stenosis and constipation

k) If the above fears and anxieties are not recognized and

PSYCHOSOMATIC CONSIDERATIONS IN SURGICAL PRACTICE*

The surgeon can no longer practice his specialty as an isolated and distinct entity, if he is to cure the whole patient he must offer him the best total care available

The emotionally well-adjusted patient as well as the emotionally-disturbed patient can benefit from the kind of psychological preparation outlined below

A GENERAL PRINCIPLES GOVERNING PSYCHOSOMATIC TREATMENT

1 The patient must receive the best overall medical care—before, during and after surgery
2 Prevent emotional stress before anesthesia Preliminary emotional support is essential
3 Prevent emotional upsets in the immediate and late postoperative periods
4 The patient must be emotionally prepared and properly indoctrinated towards his diagnosis and recommended surgery to avoid apprehension and fear
5 Postoperative measures should aim at facilitating total rehabilitation of the patient
6 In unhappy surgery performed for incurable and malignant diseases—there is a limitation to the amount of rehabilitation one can accomplish
7 In happy surgery—the patient should be prepared for his good fortune—otherwise despite good anesthesia and excellent surgery he may fail to function as a normally integrated and mature person

B PREOPERATIVE PSYCHOTHERAPY

1 **Prepare Patient for the Ordeal of Surgery**

(Good emotional preparation does not imply elaborate psychologic preparation)

a) Office briefing to allay anxiety and fear gives patient emotional security and obviates later psychosomatic complications

1) Patient takes anesthesia more easily
2) Patient suffers less postoperative discomfort and pain
3) Patient requires less drugs
4) Patient recovers faster

2 **Know What Goes On in the Mind of the Unoperated Surgical Patient**

a) He is usually apprehensive and fearful
b) His life and work will be abruptly altered

* Psychosomatic Aspects of Surgery by Alfred J Cantor and Arthur N Foxe The Proceedings of the First Annual Meeting of the Academy of Psychosomatic Medicine N Y C 1954 Grune and Stratton N Y

THE CARDIAC SURGICAL PATIENT

I GENERAL CONSIDERATIONS AND PRINCIPLES

A Cardiac patients tolerate surgical procedures fairly well

B The cardiac conditions causing most postoperative complications are

1 Congestive heart failure
2 Myocardial Infarction
3 Angina Decubitus
4 Stokes—Adams Syncope

II PREOPERATIVE CONSIDERATIONS

A Evaluation and improvement of cardiac function is essential to successful surgery

1 CARDIAC PAIN—occurring with greater frequency and angina that is becoming more severe or coming on with less physical effort, should be evaluated and treated for myocardial infarction

2 DYSPNEA AND EDEMA—suggests congestive heart failure Digitalization (rapid or slow) depending on the urgency diuretics and Low-Sodium diet are indicated

3 ARRHYTHMIAS

a) Auricular fibrillation, extrasystoles and proxysmal tachycardia do not necessarily contraindicate surgery

b) Ventricular Tachycardia and heart block are considered serious cardiac irregularities

c) Controlled heart rate and the extent of myocardial damage will determine degree of cardiac reserve

4 HYPERTENSION—per se, is no contraindication to surgery High blood pressure associated with congestive heart failure and cardiac hypertrophy can and should be improved before surgery Medication, sedation and appropriate anesthesia are essential toward a successful surgical outcome

B THE ANESTHESIA—is of utmost importance to the cardiac patient

1 Smooth induction, avoidance of struggle and early recognition of gross cardiac irregularities are essential
2 Adequate pulmonary ventilation cannot be compromised
3 Position of patient must not jeopardize respiratory exchange
4 Sudden drop of B P should be avoided
5 Shock must be prevented
6 Overloading the circulating fluid volume can become serious

III POSTOPERATIVE MANAGEMENT OF CARDIACS

The common causes of postoperative death in cardiac patients are

1 Congestive heart failure
2 Coronary thrombosis

promptly treated with psychotherapy—the patient may emerge with disabling chronic psychosomatic complaints de spite excellent surgery

l) Religious faith is a most valuable adjunct in promoting recovery Encourage mobilization of spiritual resources

m) The surgeon himself must never be guilty of evoking emotional instability and fear in his patient It is possible through verbal or non verbal communication, for the surgeon to unwittingly instill great fear into his patient—so much so—as to cause the patient to delay, change his mind or go elsewhere for another consultation

6 **Prepare Patient's Family**

a) It is customary to inform and prepare the family as well as the patient at times it may be wiser to inform the family—but not the patient A Solomon's judgment is often required

b) Explain to family how their attitude and behaviorisms can precipitate serious psychosomatic complications in the patient Instruct them to mask their emotions

7 **Prepare Patient to Cooperate in the Postoperative Period**

Instruct the patient as follows

a) Deep breathing, coughing, kicking and side to-side turning immediately after surgery is highly desirable

b) **Don't lie quietly in bed!** Explain to the patient how early activity improves the circulation point out—how lying in bed too quietly interferes with the efficiency of his return circulation from his legs show how venous stasis predisposes to increased clotting tendency with resulting complications (i e) thrombophlebitis and phlebothrombosis

c) Explain why pillows under the knees are considered deleterious and predispose to lying in bed too quietly

d) Report any pain in the legs immediately

e) Need of private nurses etc

NOTES

THE RENAL SURGICAL PATIENT

I GENERAL CONSIDERATIONS AND PRINCIPLES

A MILD RENAL IMPAIRMENT—does not contraindicate major surgery

B SEVERE RENAL IMPAIRMENT—may offer a serious contra indication to surgery Renal diseases contraindicating surgery are

1 **Acute Renal Disease**
   a) Acute Glomerulo-nephritis
   b) Acute Pyelonephritis
   c) Lower Nephron Nephrosis

2 **Chronic Renal Disease**
   a) Chronic Renal Insufficiency
   b) Azotemia
   c) Edema associated with Congestive Heart Failure
   d) Bi lateral Polycystic Disease of Kidneys
   e) Chronic Kidney obstruction
      1) Hydronephrosis Pyonephrosis
      2) Renal Calculi

C Coincidental pathological conditions known to develop or con tribute to renal impairment are
   1 Tuberculosis
   2 Generalized arteriosclerosis
   3 Hypertension
   4 Severe Diabetes Mellitus
   5 Hyperparathyroidism
   6 Congenital anomalies, i e Polycystic kidneys
   7 One remaining kidney

D Surgery undertaken on patients with impaired kidneys should be performed with the following precautions
   1 Avoid anoxemia and hypotension
   2 Carefully regulate fluid and electrolyte balance Keep careful Intake and Output record Chart
   3 Acute renal failure developing in the postoperative period calls for meticulous detail in maintaining proper fluid balance Fluid replacement must not exceed the calculated fluid loss via lungs and skin (perceptible and imperceptible) See Management of Acute Renal Insufficiency, (Lower Nephron Nephrosis)

E **Routine Preoperative Tests May Reveal Renal Disease**

1 **Urinalysis**
   a) **Inability to concentrate** urine above a specific gravity of 1 020
   b) **Presence of Albumin, Pus, Cells, R B C or casts**

3. Cerebral thrombosis or embolism
4. Atelectasis
5. Pneumonia
6. Pulmonary embolism

A MANAGEMENT

Maintain adequate fluid, electrolyte, mineral and vitamin balance

1. **I V fluids should be given slowly! (Do not overload patient!)**
2. Hypodermoclysis—where decompensation and edema are not present
3. Low or no Sodium intake
4. Maintain Intake and Output chart
5. Oxygen—(Intranasal, mask or tent)
6. Early ambulation (employ discretion and cardiac consultation)
7. G-I Tract Decompression
8. Catheterization

B MEDICATION

Continue with preoperative medication

1. Digitalis Digitoxin, Digoxin Cedilanid, Quinidine, etc
2. Diuretics (Mercuhydrin, Diomox, Diuril, etc)
3. Sedation (Barbituates)
4. Analgesics (Demoral, M S , Pantapon and Dilaudid)
5. Antibiotics (See Antibiotic Therapy)

C FOLLOW-UP

1. Electrocardiograph (serial studies)
2. Blood counts and urinalysis
3. Blood Volume studies when indicated

NOTES

THE DIABETIC SURGICAL PATIENT

The pre- and postoperative management of the diabetic, cardiac and renal patient is most efficient when the internist and surgeon co-operate The operative morbidity and mortality still remain high in this group of patients

I GENERAL CONSIDERATIONS AND PRINCIPLES

A **OPERATIVE PROCEDURES** can be carried out in diabetics with safety when the diabetes is controlled by diet or/and Insulin

B **POSTOPERATIVE COMPLICATIONS** develop more frequently in the diabetic patient Pneumonia, acidosis, and gangrene are serious hazards

C **ACUTE SURGICAL ABDOMEN** is more likely to manifest less distinct signs and symptoms in a diabetic Acute appendicitis may go on to rupture while presenting mild signs and symptoms (It is unsafe to delay surgery in diabetics because the inflammatory process is less likely to subside)

D **INFECTION** increases Insulin requirement Antibiotics should be vigorously employed

E **TRAUMA** may increase Insulin requirement

F **HYPERTHYROIDISM** by increasing basal metabolism increases the Insulin requirement

G Acute abdominal signs and symptoms resembling acute appendicitis may develop in **DIABETIC ACIDOSIS** Failure to differentiate between "acute surgical abdomen and 'diabetic acidosis may be serious

1 In **ACUTE APPENDICITIS** the usual sequence of symptoms is

a) Pain—(specific' time onset)

b) Nausea

c) Vomiting

2 In **DIABETIC ACIDOSIS** the usual sequence of symptoms is

a) Nausea

b) Vomiting

c) Pain—(Indefinite ' time onset)

It must be remembered that acute appendicitis in a diabetic may precipitate acidosis

H **IMPENDING DIABETIC COMA** is a most unfavorable condition for surgery

I **EARLY OPERATION** for eradication of a threatening disease process or early drainage of a progressive infectious process is often the only means of reversing the trend toward coma and death

c) **Pyuria**—isolate causative organism and administer appropriate therapy

d) **Hematuria**—may be an indication for I V **Pyelography and Cystoscopic** follow-up

2. **Blood Chemistry**

a) Blood urea, N P N , Creatinine and Uric Acid

NOTES

III PREOPERATIVE PROCEDURE FOR EMERGENCY SURGERY

A GENERAL CONSIDERATIONS

1. Medical management must accommodate itself to the existing surgical emergency
2. Operate the emergency first, control hyperglycemia and glycosuria later
3. Sufficient time does not exist for carrying out all the general considerations listed under elective surgery
4. Surgery may be carried out in very unusual instances during hyperglycemia and glycosuria, WHERE POSSIBLE, ACIDOSIS SHOULD BE CONTROLLED FIRST The amount of diacetic acid (not acetone) determines the degree of acidosis

B SPECIFIC CONSIDERATIONS

1. Diabetics admitted in pre-coma should be actively treated to forestall development of coma
2. DIABETICS ADMITTED IN COMA SHOULD FIRST BE TREATED FOR COMA
3. Diabetes in children is difficult to manage Their tolerance to insulin is variable and their Insulin requirements are relatively high
4. Diabetic gangrene of the foot complicated by infection (ascending lymphangitis and increasing toxemia) is best managed by applying a tourniquet above the knee and encasing the leg completely in ice This procedure allays the extreme surgical emergency by reducing systemic absorption of toxins and allows more time to administer effective antidiabetic management and antibiotic therapy

IV ANESTHESIA

A GENERAL CONSIDERATIONS

1. Avoid anesthetic agents which will induce or aggravate acidosis
2. Avoid anesthetic agents which will cause prolonged postoperative nausea and vomiting
3. Employ anesthetic agents which will allow the greatest margin of safety and highest concentration of oxygen
4. For diabetics in whom gas anesthesia is contraindicated we employ local or spinal anesthesia

B SPECIFIC CONSIDERATIONS

1 ETHER—(Contraindicated).

a) Produces mild to moderate degree of acidosis
b) Induces glycogenolysis with resultant hyperglycemia
c) Interferes with glycogenesis and glyconeogenesis

I MEDICAL MANAGEMENT must accommodate itself to the existing surgical emergency

1 Operability increases as the acidosis decreases

2 The degree of acidosis is measured by the amount of di acetic acid in the urine Acetone in the urine may be mis leading since it can appear in non diabetic states

3 In desperate emergencies operate first and control the dia betes (hyperglycemia and glycosuria) later.

4 Antibiotics shoud be used judiciously and adequately

II PREOPERATIVE PREPARATION OF DIABETICS FOR ELECTIVE SURGERY

A GENERAL CONDITIONS TO BE IMPROVED

1 Increase liver-glycogen reserve

2 Improve blood and tissue protein levels

3 Correct dehydration and electrolyte deficiencies and im balances

4 Build up vitamin stores

5 *Administer proper dosage of Insulin* Select suitable Insu lin preparation Regular Insulin NPH Zinc Insulin Lente Orinase etc

6 Prescribe proper diet

7 A complete examination with special attention given to heart kidneys and arteriosclerosis if present

8 Antibiotics should be used singly or in ideal combination It may be employed locally systemically or in any combi- nation of proven merit See Antibiotics

B SPECIFIC DIRECTIONS

1 Morning of Surgery

a) Administer ½ usual dose of Insulin (Hypo)

b) No nourishment for 12 hours preceding surgery

c) Protamine is preferable if patient has used it previous ly otherwise employ regular Insulin

d) Avoid preoperative I V fluids unless specifically indi cated Some prefer to administer 5% glucose in physi ological saline to which is added 20 U of regular Insu lin An excess of Insulin given preoperatively to cover the carbohydrate dose can produce a sudden drop of blood sugar Hypoglycemic shock may result while the patient is under anesthesia. **For this reason, we prefer to give I V Physiological Saline Solution ALONE dur- ing the operative procedure**

d) Do urine determinations q 4 hrs We prefer a slight glycosuria to Insulin-shock Check urine for Ketone bodies, particularly diacetic acid Indwelling catheter is of definite value in taking routine urine specimens q 4 hrs

e) If no blood determinations are available, use the 'Rule of McKittrick and Root' Test urine with Benedict s or any reliable testing reagent

Give 20 U regular Insulin if urine turns brick-red, 4+ Reaction

Give 15 U regular Insulin if urine turns orange, 3+ Reaction

Give 10 U regular Insulin if urine turns yellow, 2+ Reaction

Give 5 U regular Insulin if urine turns green, 1+ Reaction

VI DIET

A Liquids—Ginger ale, fruit juices and milk if tolerated within 24 hrs May supplement with I V 5% dextrose in water, add 15-20U regular Insulin

B Semi solids—Oatmeal, milk-soaked toast, custards, etc , if tolerated within 48 hrs Each feeding contains 25-50 Gms carbohydrate

C Normal eating schedule—in 1 week if tolerated

VII CONTINUOUS OBSERVATION OF DIABETIC PATIENT

A Nurse and Resident must always be on lookout for Insulin-shock
  1 Signs and symptoms are
    a) Weakness
    b) Sweating
    c) Pallor
    d) Mental Confusion
    e) Unconsciousness
    f) Coma

B Check blood sugar determination q 8 hrs
  Check urine q 4 hrs (Indwelling catheter)

C Treat Insulin shock stat with I V 5% Dextrose solution

D If patient fails to recover progressively, look for complicating factors i e
  1 Infection
  2 Concomitant systemic disease

d) Decreases clotting time and may predispose to thrombosis
e) Reduces kidney function during surgery by constricting the glomeruli

2 **CHLOROFORM**—(Contraindicated)
a) Impairs liver function (Hepato toxic)
b) Causes acidosis
c) Induces glycogenolysis and hyperglycemia
d) Interferes with oxygen hemoglobin union
e) Increases cardiac irritability and may induce arrhythmias

3 **AVERTIN**—(Contraindicated)
a) Induces glycogenolysis and hyperglycemia

4 **CYCLOPROPANE**—(Indicated)
a) Rapid action, quick induction, prompt recovery
b) Slight effect on blood sugar level
c) Allows wide margin of oxygen concentration
d) Cyclopropane and Curare are a good combination

5 **LOCAL ANESTHESIA**—(Indicated)
a) Safest anesthesia, use when appropriate

6 **SPINAL ANESTHESIA**—(Indicated)
a) Used in amputations when other anesthetics are contraindicated

7 **NITROUS OXIDE, OR ETHYLENE**—(Indicated)

8 **PENTOTHAL SODIUM AND CURARE**—(Indicated)
a) Must be used with caution!

V POSTOPERATIVE CARE

A Maintain adequate fluid electrolyte Insulin vitamin and mineral balance
1 3 4000 cc I V fluids q 24 hrs
2 Urinary output should be 1000 cc or more in 24 hours
3 Preferably give Physiological Saline Solution immediately after surgery!
4 5% dextrose solution is given only if indicated When giving 1 liter of 5% dextrose solution cover with 15 20 U regular Insulin
5 Insulin
a) Small frequent doses prevent Insulin shock (hypoglycemia)
b) Immediately after surgery use regular Insulin avoid Protamine Zinc Insulin (Crystalline Insulin is more suitable for correcting sudden fluctuations in blood sugar.
c) Do blood sugar determinations q 6 or 8 hrs as required

appendix may be located higher in later pregnancy—and localized tenderness may be obscured

c) Signs and symptoms of early abortion, hemorrhage and shock may mask a concomitant acute appendicitis

d) Acute appendicitis in a pregnant woman at term may have to be operated but the surgeon must not risk performing a non indicated Caesarian Section at the same time

2. **TWISTED OVARIAN CYST OR PEDUNCULATED FIBROID**

3. **PERFORATED HOLLOW VISCUS**

PRINCIPLE NO 3

A **URGENT SURGERY**—may have to be performed in certain instances to prevent difficult or impossible delivery

a) **FIBROIDS**—removed by myomectomy in early pregnancy—should not be performed unless considered absolutely urgent The risk of hemorrhage and abortion is too great

b) **OVARIAN CYST**—may be removed during early pregnancy without great risk of abortion CORPUS LUTEUM —removed with ovary in early months of pregnancy may induce abortion It may be wiser to defer removal of non-symptomatic ovarian cysts—until after 4th month—at which time placental hormones presumably carry on the pregnancy

NOTES

THE PREGNANT SURGICAL PATIENT

By

WALTER J REICH, M D

Professor of Gynecology at Cook County Post Graduate School Sr Attending Gynecologist at Cook County Hospital Chairman of Obstetrics and Gynecology at Grant Hospital Chicago Illinois

and

MITCHELL J NECHTOW, M D

Assoc Professor of Gynecology at Cook County Post Graduate School Assoc Attend Gynecologist at Cook County Hospital Chief of Obstetrics and Gynecology at Norwegian American Hospital Chicago Illinois

QUESTIONS ABOUT OPERATIVE RISK IN PREGNANCY

1 When should surgery during pregnancy be performed?
2 *What are the calculated operative risks during pregnancy?*
3 What is the infant mortality after surgery performed during pregnancy?
4 How should Hyperthyroidism during periods of pregnancy be treated?

FACTS ABOUT PREGNANT WOMEN

1 A normal pregnancy should have no debilitating effect upon the woman
2 Many women feel better generally during periods of pregnancy
3 Anesthesia—properly administered—offers no greater hazard to a pregnant than non-pregnant woman
4 In complicated pregnancies—an abdominal operation offers greater risk
   A) **Hyperemesis Gravidarum**—increases surgical risk because of *accompanying starvation dehydration avitaminosis and acidosis* Correction of fluid and electrolyte balance will decrease the operative risk
   B) **Pre Eclampsia**—markedly enhances the surgical risk

PRINCIPLE NO 1

A **ELECTIVE SURGERY**—should be deferred until after delivery

PRINCIPLE NO 2

A **EMERGENCY SURGERY**
   1 **ACUTE APPENDICITIS**—is probaby the commonest problem complicating pregnancy
      a) Appendectomy should be performed promptly—before organ ruptures premature labor or abortion is unlikely
      b) Delay—in diagnosis and treatment is not uncommon An

Effectively blocks the vago vagal reflex, may prevent cardiac arrest

D BARBITURATES—(Nembutal, Phenobarbital, Seconal)

1 Lower metabolism by allaying excitement and fear
2 Favor a good night s rest before surgery
3 Prophylactic premedication against toxic reaction caused by local anesthetic drugs, i e Novocaine and Xylocaine
4 Barbiturates are well tolerated by infants and children They also contribute to smooth anesthesia and convalescence

E PHENERGAN—Effectively used with Demerol

IV GENERAL PLAN FOR PREMEDICATION DOSAGE

Age 0-1
No Morphine or Demerol
No Atropine Sulphate

Age 1-2
No Morphine or Demerol
Atropine, gr 1/200

Age 2-5 and over 70
Morphine gr 1/12 to gr ⅛, or Demerol 25-50 mg
Atropine gr 1/200 to gr 1/150

Ages 5-10 and 60-70
Morphine gr ⅛ or Demerol 50 75 mg
Scopolamine gr 1/200

Ages 10 60
Morphine gr ⅛ to gr ⅙ or Demerol 50-75 mg
Scopolomine gr 1/200 to gr 1/150

V SOME CONSIDERATIONS ON CHOICE OF ANESTHESIA

A Avoid spinal anesthesia in the gravely ill patient With certain exceptions spinal anesthesia is best reserved for the better risk patient In instances where no other anesthesia is available spinal anesthesia should be employed

B Regional blocks i e brachial, intercostal, sciatic and femoral block procedures may be employed with advantage in certain instances Regional blocks seldom alter the physiology of the body and therefore do not tax those patients with limited re serve

C Pentothal Curare and Succinylocholine are not innocuous drugs One must remember that there is a close relationship between the preanesthetic and anesthetic dose in the poor risk patient

E INDICATIONS FOR INTUBATION

1 WHENEVER SIMPLIFIED METHODS OF AIRWAY CONTROL ARE INADEQUATE OR UNSAFE
2 When the upper respiratory tract is inaccessible to the anesthesiologist

ORDERS FOR PRELIMINARY NARCOSIS AND ANESTHESIA FOR SURGICAL PATIENTS

I PREMEDICATION—with narcotics or sedatives offers the following advantages

A Decreases reflex irritability and suppresses secretory activity

1 Reduces apprehensiveness and nervous tension

2 Suppresses bronchial and salivary secretions thereby assisting in gas exchange through the alveolar membrane

B Minimizes the amount of anesthetic required

1 10% less Cyclopropane is required to obtain relaxation when patient is premedicated with morphine or Pentothal sodium This increases the margin of safety

C Increases the amount of oxygen given during anesthesia

D Barbiturate premedication protects against toxicity of local anesthetic drugs

E Reduces metabolism in proper dosage

1 **The higher the metabolism, the greater the narcotic dose required Pain, fever and excitement increase metabolism thereby raising the usual narcotic dosage**

F Raises pain threshold

G Counteracts the side effects of anesthetic drugs

II SOME CONSIDERATIONS IN PREMEDICATION

A When the systolic blood pressure is above 90 mm Hg the preanesthetic drugs will usually be absorbed from the subcutaneous and muscular layers

B When the systolic blood pressure reaches shock level all medications should be administered intravenously

C Premedication given too late may exert its maximal effect at a time when the plane of anesthesia is deepest This may result in severe respiratory depression

III PREANESTHETIC AGENTS COMMONLY EMPLOYED

A MORPHINE SULPHATE OR DEMEROL (PETHIDINE)

Excellent hypnotic and analgesic

B SCOPOLAMINE

1 Offsets depressing effect of Morphine and Demerol on respiratory center by its stimulating effect

2 Reduces metabolism by reducing excitement

C ATROPINE SULPHATE

1 Stimulates respiratory center, thereby offsetting the depressing effect of Morphine and Demerol

2 Suppresses salivary and mucous gland secretion

3 Atropine has an advantage over Scopolamine when used in infant and old age patients The latter drug induces restlessness

3 Expected blood loss
4 Position of patient
5 Age of patient
6 Nutritional status of patient
7 Associated diseases

B General anesthetic agents are employed either singly or in combination, they are

1 ETHER
   a) DESIRABLE FEATURES
      1) Most widely used anesthetic
      2) Favors shock by lowering blood pressure
      3) Ideal in Pediatric surgery
      4) Preferred for splenectomy
         a) Contracts spleen and thereby decreases blood loss, (sympathomimetic drug)
   b) UNDESIRABLE FEATURES
      1) Hepato-toxin
      2) Favors shock by lowering blood pressure
      3) Irritates respiratory mucosa, although some still prefer Ether in thoracic surgery
      4) Postoperative retching and vomiting is common
      5) Explosive gas
      6) Induces hyperglycemia avoid in diabetics
      7) Induces Ether acidosis, avoid in diabetics

2 CYCLOPROPANE
   a) DESIRABLE FEATURES
      1) Induces relaxation
      2) Allows higher oxygen concentration
      3) Short acting conducive to quiet induction and quiet respirations
      4) Requires light premedication
      5) Does not irritate respiratory mucosa, useful in neck and thoracic surgery
      6) Slight effect on blood sugar, used in diabetics
      7) Slight effect on G-I tract motility
   b) UNDESIRABLE FEATURES
      1) May cause cardiac irritation, arrhythmia or laryngospasm
      2) Relaxes spleen predisposes to greater blood loss in splenectomy, (Vagomimetic drug)
      3) Curare may be required for effective relaxation
      4) Undesirable in asthmatics may induce asthmatic attack (Vagomimetic)

3 NITROUS OXIDE
   a) DESIRABLE FEATURES
      1) Acts rapidly

3 Possibility of contaminating the respiratory tract, (i e) aspiration pneumonia
4 When abnormal anatomy or a disease process precludes safe control of airway
5 The surgeon is permitted more maneuverability when anesthetic equipment is removed from his operative field
6 Dead space in a closed system is reduced and less CO_2 is allowed to develop
7 CONTROLLED ARTIFICIAL RESPIRATION IS AVAILABLE AT ALL TIMES
8 When a patient, (i e) cardiac, cannot tolerate periods of hypoxia
9 Pentothal sensitizes the larynx to slight irritation so that if blood mucus or stomach content come in contact with the glottis laryngospasm may result

VI LOCAL ANESTHESIA

A All adult patients operated upon under local anesthesia should have routine similar to Thyroid Premedication (See "Thyroid Premedication)

1 PREMEDICATION

a) Demerol, 75-100 mg, Scopolamine, gr 1/150 } 1 hr before surgery

b) Give an additional dose of morphine gr ⅛ to gr ⅙ (½ to 1 hr before surgery if respirations remain higher than 20 and the pulse higher than 70 per minute

c) All patients receiving Novocaine infiltration are prophylactically given a barbiturate to counteract possible Novocaine toxicity

B NOTE FOR NURSES

As soon as premedication is given

1 Darken patient's room and close door
2 Plug patient s ears with cotton
3 Cover patient s eyes with gauze, then loosely cover with folded towel
4 Allow no one to converse with patient, or make any careless remarks

VII GENERAL ANESTHESIA—(inhalation)

A Almost all cases are done under general anesthesia unless contraindicated The surgeon in consultation with the anesthesiologist should select the anesthesia as well as the pre- and postoperative sedation **Every patient should be considered individually** Before selecting the anesthetic the following factors are considered

1 Type of operation
2 Duration of surgery

The above drugs act to favorably induce hypothermia They depress the Autonomic Nervous System and enhance the anesthetic effect by depressing the Central Nervous System as a whole By also depressing the temperature regulating center, the above drugs further serve to potentiate hypothermia

E COMPLICATING FACTORS IN HYPOTHERMIA

1. As temperature drops to 30°C—**hyperventilation** may develop with resulting **alkalosis**
2. A temperature drop to 28°C or less, may include **apnea** which may necessitate artificial respiration Hyperventilation with a high percentage of oxygen is necessary at this point
3. When the temperature reaches 22°C or less, an increased tendency toward ventricular fibrillation develops This complication may result from an increase in the pH of the myocardium
   a) KCl is used to defibrillate the heart and 10 cc $CaCl_2$ (10%) is injected into the left ventricle to restore cardiac function

NOTES

2) Recovery is rapid
3) Ideal for short operations where relaxation is not essential
4) No disagreeable odor
5) Used effectively with pentathol sodium, so-called, 'balanced anesthesia'
6) Non-explosive gas

b) UNDESIRABLE FEATURES
1) Relaxation is difficult to produce without danger of asphyxiation
2) Low margin of oxygenation
3) Requires heavy premedication

4 ETHYLENE

a) DESIRABLE FEATURES
1) Rapid induction with small concentration
2) Induces moderate relaxation
3) Desirable for short procedures where relaxation is not necessary

b) UNDESIRABLE FEATURES
1) Avoid Ethylene alone if third plane relaxation is essential
2) Explosive gas
3) Requires heavy premedication

VIII **HYPOTHERMIA**

A Hypothermia decreases tissue metabolism and oxygen consumption It permits major cardio vascular surgical operations to be performed without great blood loss and without grave shock

B If during the cooling process shivering develops—it may be eliminated by deepening the anesthesia or administering a curare-like drug Hypotension develops with hypothermia but it is not considered dangerous

C METHODS OF ESTABLISHING HYPOTHERMIA
1 By immersing patient in ice water
2 A cooling-blanket through which cold water circulates
3 Instillation of cold Physiological Saline Solution into body cavities (i e) thoracic and abdominal
4 Methods 1) and 2) are most commonly employed It requires about 1-1½ hrs to drop the temperature to 30°C The temperature continues to drop slowly—and may be kept at any desired level (20°C-26°C), until rewarming is instituted

D ADJUNCTS TO HYPOTHERMIA
1 Thorazine (Chlorpromazine)
2 Phenergan
3 Barbiturates

b) Active

1) Gastric lavage and continuous Levin-Wangensteen suction
2) Release abdominal pressure caused by tight binder or dressing
3) CO_2 inhalation—no more than 8-10 inhalations at one sitting
4) Phrenic Nerve injections with 1% Novocaine should be last resort
5) Tranquilizers and sedatives are useful ANTIEMETIC DRUGS (i e) Compazine, Dramamine, Thorazine and Phenergan are effective in mild cases of hiccough

NOTES

IMMEDIATE POSTANESTHESIA PERIOD

A DEPRESSION

1 Postanesthetic depression of normal functions is an abnormal state and predisposes to
  - a) Postanesthetic morbidity and mortality
  - b) Atelectasis
  - c) Phlebothrombosis
  - d) Pulmonary Embolism

2 **Treatment of Prolonged depression is directed toward**
  - a) Eliminating inhalation agents by increasing minute volume exchange
  - b) CO_2 administered to obtain hyperpnea Continue until patient hyperventilates voluntarily
  - c) Analeptics—may be used

B ATELECTASIS

1 **Anesthesiologist**—first to recognize signs and symptoms
  - a) **Pulse**—rapid, out of proportion to temperature rise
  - b) **Respirations**—rapid and labored
  - c) **Chest wall**—lags

2 **X-Ray**—Findings develop late

3 **Treatment**—
  - a) **Turn patient** side to-side
  - b) **Encourage deep breathing** and coughing
  - c) **Slap**—suspected chest wall
    - 1) May dilsodge mucous plugs
  - d) **Suction machine**—aspirate with rubber catheter may employ long Levin tube
  - e) **Bronchoscopy**—if above measures fail

C HICCOUGH

1 A spasmodic contraction of the diaphragm occurring concomitantly with closure of glottis inspiration is impeded and the characteristic sound of hiccough is produced

2 **Causes of Hiccough**
  - a) Hypoxia of center controlling respiratory musculature
  - b) Surgical trauma to phrenic nerve
  - c) **Diaphragmatic irritation**—caused by
    - 1) Gastric dilatation
    - 2) Bowel distention
    - 3) Bowel obstruction
    - 4) Paralytic ileus
  - d) Any upper abdominal surgery, (i e) gallbladder, colon spleen and pancreas

3 **Treatment**
  - a) **Prophylactic**—(observe all surgical principles)

POSTOPERATIVE COMPLICATIONS AND THEIR MANAGEMENT

A THE RECOVERY WARD—is one of the most effective prophylactic measures against postoperative complications It should exist in all hospitals where surgery is done

1. The unconscious patient should be transported to the Recovery Room, flat on his back or with head slightly lower than the feet
2. During transport—patient's airway should be kept open and constantly checked
3. Avoid accumulation of salivary and tracheal secretions—and guard against aspiration of gastrointestinal secretions Prophylactic use of Levin Wangensteen Suction and siphonage of oral and tracheal secretions will effectively prevent postoperative atelectasis, pneumonia and pneumonitis
4. Recovery Ward—advantages are
   a) All anesthetized patients are close to O R facilities
   b) Experienced and intelligent personnel are readily available to all postoperative patients routinely and as a team
   c) Resuscitative equipment is instantly available
      1) Oxygen tracheotomy set-up intubation equipment, suction machines shock frames and many life-saving drugs

B EARLY COMPLICATIONS (24 to 48 hrs)

1. **Acute Respiratory Distress**
   a) Obstruction
   b) Laryngeal spasm
   c) Atelectasis
   d) Narcotic drug depression
   e) Tight abdominal and chest binder
   f) Pulmonary edema
2. **Acute Cardiac Distress**
   a) Cardiac Arrest (See ' Cardiac Arrest)
   b) Cardiac Failure (Acute Cardiac Decompensation)
3. **Shock**
   a) Hemorrhagic (See Shock)
   b) Neurogenic
4. **Nausea and Vomiting**
5. **Acute Gastric Dilatation**

C LATE COMPLICATIONS (Over 48 hrs)

1. **Respiratory**
   a) Atelectasis
   b) Pneumonitis
   c) Pneumonia
   d) Pulmonary embolism (See— Venous Thrombosis)
2. **Abdominal**
   a) Paralytic ileus

POSTOPERATIVE ANESTHETIC PROBLEMS

The Anesthesiologist should routinely co operate with the surgeon in the prevention and treatment of postoperative complications Lung complications, hypoxia spinal headaches, pulmonary embolism and cerebral edema following cardiac arrest are not infrequent postoperative complications

A **Lung complications**—may be prevented by routinely observing the following

1. **Stir-up regimen**
   a) Deep breathing
   b) Side-to-side turning
   c) Encourage coughing
   d) Early ambulation (leg and foot exercises)
2. **Intercostal blocks**—are of value when patients refuse to cough because of pain
3. **Laryngeal and Tracheal Suction**—is of value when deep secretions cannot be coughed up
4. **Bronchoscopy**—is valuable when atelectasis develops as a result of aspiration of foreign bodies
5. ***Blow bottles*** *help to expand the lungs*
6. **Antibiotics** may prove beneficial in preventing or controlling infection

B **Hypoxia** may be prevented by routinely employing intranasal oxygen in all cardiac and poor risk patients

C **Spinal Headache** may be benefited by analgesics narcotic drugs and adequate hydration

D **Pulmonary Embolism**—see—'Venous Thrombosis and Pulmonary Embolism

E **Cerebral Edema Following Cardiac Arrest**—results from prolonged anoxia Oxygenation to the brain must be continued into the postoperative period with the same enthusiasm as during the cardiac arrest (Salt-free Human Albumin may be used with some benefit to reduce brain edema 60 cc. (I.V.) allowed to run in quickly (5 minutes)) Fluid restriction is carefully observed We do not employ 50% Sucrose Solution because of Rebound edema to the brain (See—'Cardiac Arrest)

3 Atelectasis—is manifested by
- a) Elevated temperature, pulse and respirations
- b) Slight cyanosis and dyspnea
- c) Decreased breath sounds and resonance
- d) X-Ray may show nothing early, after 18-24 hrs a patchy bronchopneumonia and elevated diaphragm on the affected side may be recognized

4 Stir up regimen—which includes deep breathing, coughing and turning side to side, will in most instances prevent this complication

5 Aspiration via bronchoscope may have to be done X-Ray films (A-P, lateral and oblique) may help diagnose condition If reaccumulation of secretions develop after bronchoscopic aspiration—a prophylactic tracheostomy may have to be performed

6 Antibiotics, aerosol or antibiotic aerosols may be utilized (See 'Antibiotics in Surgery ")

F **HEMORRHAGE—(Internal or External) (See "Shock")**

1 Constantly inspect dressings for evidence of bleeding

2 Constantly check B P , pulse and respirations to detect incipient signs or symptoms of shock Such early detection can lead one to treat intra abdominal bleeding early

3 Common sites of bleeding are
- a) Gastric surgery—bleeding at site of anastomosis, aspiration indicates blood
- b) Gall bladder surgery—bleeding usually from cystic artery
- c) Hysterectomy—bleeding usually from ovarian and uterine arteries
- d) Pancreatectomy—bleeding usually from smaller branches of superior mesenteric artery and vein
- e) Appendectomy—bleeding usually from appendiceal artery
- f) Splenectomy—bleeding usually from splenic arteries and veins

G **PERITONITIS AND LOCALIZED ABSCESS**

1 **Peritonitis despite antibiotic and chemotherapy still remains the number one cause of postoperative death**

2 Causes of postoperative peritonitis are
- a) Leakage from suture lines
- b) Contamination during surgery

3 Localized peritonitis (abscess) commonly develops in
- a) R L Quadrant (appendectomies)
- b) Cul de sac, (pelvic surgery)
- c) Subhepatic and subdiaphragmatic, (cholecystectomy and gastric resection)

4 Peritonitis (Local or Generalized) is diagnosed by
- a) Fever—(chills and fever at times)
- b) Tachycardia

b) Mechanical intestinal obstruction
   1) Congenital
   2) Acquired
c) Peritonitis
   1) Localized (abscess)
   2) Generalized
d) Wound infection
e) Wound dehiscence
f) Evisceration
g) Intestinal fistula

3 **Bladder**
a) Atony of the bladder
b) Vesical Neck obstruction
   1) Prostatic enlargement
   2) Spasm
c) Cystitis

4 **Extremities**
a) Thrombophlebitis (See "Venous Thrombosis")
b) Phlebothrombosis

D POSTOPERATIVE ILEUS

1 Mild ileus—or "gas pain" is a common incident in the postoperative period It is invariably transient

2 Marked ileus—or "distension with gas pain" requires decompression for relief

3 Certain operative procedures are commonly followed by marked ileus and are best managed with routine Levin-Wangensteen Suction The following procedures do best with routine decompression
a) Cholecystectomy
b) Gastrectomy
c) Extensive pelvic surgery
d) Bowel anastomoses
e) Splenectomy
f) Nephrectomy
g) Lumbar Sympathectomy
h) Peritonitis

4 In cases where a congenital band (i e Lane's band) is present—a marked paralytic ileus may become transformed into a mechanical obstruction requiring surgery

E ATELECTASIS—an incomplete expansion of the lung (massive or patchy)

1 Atelectasis (massive or patchy) occurs usually in the first 3 postoperative days it is caused by bronchial obstruction due to a mucous plug

2 A high percentage of so-called postoperative pneumonias are in reality atelectasis

1 **Staphylococcal Hospital Infections**

a) The problem of hospital infection is not a temporary one

b) Successful control cannot be obtained by the discovery of new antibiotic agents alone It must be predicated on strict aseptic technique in all departments of the modern hospital

c) Experience would indicate that hospital personnel with active infections contribute more to the spread of the organism than do healthy nasal carriers

d) Adoption of the following corrective measures will do much toward eliminating the Hemolytic Staphylococcus Aureus hospital infection problem

1) Hospital Committee to analyze infections
2) Eliminate O R personnel with any infections
3) Knowledge of local offending organism
4) Knowledge of antibiotic susceptibility to last infection treated
5) Avoid mixing clean surgical patients with 'dirty surgical patients
6) Surgeon should check bacteria in his own nasal and oral secretion An antiseptic nasal spray before surgery may be advisable
7) Routinely wash hands with soap and water after treating patient **Isolation Technic**—on all proven Staph' infections
8) Surgical soap should be sterile
9) Sterile technic should be perfect
10) All blankets should be sterilized after use
11) Surgical mask should be changed between cases
12) Special handling of contaminated linens, isolation containers
13) Housekeeping personnel should be instructed how and when to dust walls and O R equipment
14) Special handling of instruments and dressings after treating infected wound
15) Change O R attire before making hospital rounds
16) Visitors—like the surgeon should change attire before entering O R
17) Judicious use of preoperative antibiotics
18) **Skin preparation of operative site before surgery should be ideal and routine, scrub initially with soap and water, follow with ether, and finally paint skin widely with antiseptics i e Merthiolate (Lilly), Zephiran (Winthrop), Metaphen (Abbott), or Mercresin (Upjohn) Avoid touching skin during surgery!**
19) Proper handling of towels, sheets and drapes while covering patient

c) Abdominal tenderness (rebound)
   1) Localized
   2) Generalized
d) Abdominal distention
e) Leukocytosis (High—except in the aged)
f) Absent peristalsis (silent abdomen)
g) Nausea vomiting and diarrhea
h) Palpation and percussion may reveal abscess mass
i) X-ray may reveal elevated diaphragm

5) **Treatment**
   a) **Prophylactic**
      1) Good pre- and postoperative care
      2) Good surgical technic—non traumatic
      3) Judicious use of antibiotics and chemotherapy (local and systemic)
   b) **Active**
      1) Intestinal decompression
      2) Parenteral fluids electrolytes and nutritional elements
      3) Intensive Chemotherapy and Antibiotics
         (a) May employ 1 or more synergistic antibiotics
      4) Excellent nursing care
      5) Fowler s position

NOTE
   1) ROUTINE USE OF ANTIBIOTICS IS NO SUBSTITUTE FOR GOOD SURGERY
   2) NO ANTIBIOTIC NOR ANY AMOUNT CAN OVERCOME PERITONITIS RESULTING FROM CONTINUOUS SPILLAGE SURGERY IS THE ONLY ALTERNATIVE

H WOUND INFECTIONS

1. Careful observance of surgical principles and meticulous attention to septic and gentle surgical technic will almost invariably prevent postoperative wound infections
2. Gastro intestinal surgery—(especially colon and small bowel) may at times predispose to contamination proper walling off with laparotomy pads will help to prevent contamination of wound
3. Temperature tachycardia pain in the operative area leukocytosis and soiled dressings help recognize the presence of wound infection
4. Smears cultures and sensitivity tests help select the ideal antibiotic

I HOSPITAL INFECTIONS*—(A WORLD-WIDE PROBLEM)

*Exhibit at A M A Convention at San Francisco 1958 Steel H H Shreck K M Caswell H T Learner N and Carrington E R exhibit supported by Merck Sharp and Dohme Inc Phil Pa

2 Resection of involved bowel with anastomosis may completely eradicate the complication

L URINARY RETENTION—This complication is recognized when

1 Patient is unable to urinate
2 Bladder is distended
3 Overflow urinary dribbling

1 Catheterization—should be avoided unless necessary The patient should be allowed 8 to 10 hours and the opportunity to stand up if possible—to urinate spontaneously

2 Cystitis—commonly follows indiscriminate catheterization, despite antibiotic prophylaxis

3 Catheterization—must be carried out under strict aseptic precautions When prostatism exists, a Foley catheter, indwelling, is best, it eliminates repeated risks of catheterizations

4 Antispasmodics—sedatives and cholinergic drugs may be employed—on order of surgeon

NOTES

20) Proper movements in O R to prevent 'break in sterili ty" Our motto is, "Move slow—think fast!"
21) All Operating Room personnel—(medical and non-medical) must wear masks

J EVISCERATION—(OR EVENTRATION)

1 A protrusion of abdominal viscera through an abdominal wound
2 **Postoperative Evisceration**—occurs most often in
a) Faulty abdominal wound closures
b) Malnourished patients with debilitating disease (i e) carci noma
c) Obese patients
d) Chronic cough
e) Paralytic ileus
f) Ascites
3 Earliest indications of impending evisceration are
a) Sero-sanguinous drainge from wound
b) Patient may state, **"I coughed—and something gave"**
c) 1st manifestation may be actual visceral protrusion
4 Once the diagnosis of evisceration has been made—the procedure is as follows
a) Sterilely wrap the exteriorized bowel with sterile (moistened) towels
b) Premedicate patient with Demerol 100 mg , stat!
c) Administer a wide spectrum antibiotic via hypo-stat!
d) Send patient to O R —stat!
e) Under general anesthesia, carefully return viscera to abdomi nal cavity and close wound with through and-through heavy wire or silver

K INTESTINAL FISTULA

1 A communication between the bowel lumen and the exterior
2 The higher the fistula in the small intestine, the greater is the difficulty with water and electrolyte loss
3 The higher the fistulous tract—the greater is the digestive action of its juices
4 Fluid and electrolytes must be replaced
5 **Some methods of treatment are**
a) Proximal control of intestinal fluid loss by passage of Levin or Miller-Abbott tube
b) Aspiration of intestinal fluid by catheter attached to suction pump
c) Aluminum paint powder, or paste is used to protect skin about fistulous opening
d) Surgery may accomplish the following
1) Lysis of adhesions distal to fistula may promote closure

2 Resection of involved bowel with anastomosis may completely eradicate the complication

L URINARY RETENTION—This complication is recognized when

1 Patient is unable to urinate
2 Bladder is distended
3 Overflow urinary dribbling

1 Catheterization—should be avoided unless necessary The patient should be allowed 8 to 10 hours and the opportunity to stand up if possible—to urinate spontaneously

2 Cystitis—commonly follows indiscriminate catheterization, despite antibiotic prophylaxis

3 Catheterization—must be carried out under strict aseptic precautions When prostatism exists, a Foley catheter, indwelling, is best, it eliminates repeated risks of catheterizations

4 Antispasmodics—sedatives and cholinergic drugs may be employed—on order of surgeon

NOTES

CARDIAC ARREST

I DEFINITION

Cardiac arrest is a state of cessation of effective heart function usually occurring with unexpected suddenness during surgery

II FREQUENCY

Cardiac arrest appears to be increasing in frequency It occurs in approximately 0 1% of the major surgical cases This figure may increase with the performance of a larger number of intra-thoracic operations Approximately 20% of cardiac arrests occur in children under 10 years of age, while the incidence of the male involvement is 2 to 1 over the female

III ETIOLOGY

There is no single etiological factor responsible for Cardiac Arrest *There is, however, a complexity of factors—each contributing* in some measure toward this unfortunate occurrence

A PREDISPOSING FACTORS

1. **Hypoxia**—or a deficient oxygen supply can render the heart more irritable Excessive depth of anesthesia poor respiratory exchange resulting from obstruction and overdosage with narcotics can also predispose toward hypoxia and anoxia Other factors (i e) shock hypotension, anemia and poor position of patient can seriously jeopardize a safe cardio-respiratory exchange
2. **Hypercarbia**—or an excess of CO_2 can seriously affect the heart action An excess of CO_2 accumulation occurs in all conditions listed under HYPOXIA

B PAIN REFLEXES—developing during fracture manipulation undue visceral handling and intubation procedures can in some patients with degenerated or irritable myocardia result in cardiac arrest Blocking afferent pathways locally with 1% Novocaine may effectively reduce pain reflexes Unfortunately poor operative technic (i e) (pawing over the viscera) and prolonged periods of surgery (i e) (prolonged periods of poisoning the patient with potent anesthetic drugs) are contributory factors **The subjects of "Inadequate" and "Poor" operative technics are very seldom if ever, discussed**

C ACUTE MYOCARDIAL FAILURE—may result from

1. Spinal anesthesia
2. Excessively deep general anesthesia
3. Cyclopropane anesthesia complicated with the use of Adrenalin
4. Shock resulting from massive hemorrhage or hypovolemia (Impending-Shock)

TREATMENT OF CARDIAC ARREST

I PROPHYLACTIC MEASURES

IT IS FAR BETTER TO AVOID THE PREDISPOSING AND EXCITING FACTORS THAT LEAD TO CARDIAC ARREST, THAN TO BECOME EXPERT IN ITS ACTIVE TREATMENT

The prophylactic management of cardiac arrest means that whenever possible—every patient should be brought to surgery electively and/or at his optimal best

A **A blood Volume** estimation wherever possible should be done Indirect evaluations are misleading and not too reliable

B **Cardiac Efficiency**—must be maintained Digitalis Quinidine and diuretic drugs must be employed when indicated Medical consultation should be sought

C **Adequate Respiratory Exchange**—must be maintained at all times in order to avoid

1. Hypoxia
2. Hypercarbia
3. Pain reflexes, (coronary spasm produces angina pectoris)
4. Acute Myocardial Failure

D **Gentle handling of tissues,** no pawing or "tugging Love and Attention is our keyword

E **Adequate Anesthesia**—should be given That is the anesthesia must be suited to the patient and the disease The plane or depth of anesthesia should be adjusted to the magnitude of the surgery at hand

F **Premedication**—must be in adequate dosage Atropine Sulphate may be effective in blocking the vagal reflex and thereby prevent cardiac arrest

G Local anesthetic blocks in sensitive areas may prevent the origin of pain reflexes (Intercostal block coeliac axis block, etc)

H **Periodic Seminars on Cardiac Arrest and Its Prevention—**

1. Anesthetists Surgeons and Hospital Surgical and Medical Personnel should be required to attend

I **Hospital co operation**

1. Defibrillation Electrical Equipment
2. Cardiac monitors and
3. Emergency kits must be available

II ACTIVE TREATMENT

A **Cardiac Arrest exists when the pulse cannot be obtained**

B Don t call for an E K G !
Don t call for needles and medications!
Don t call for blood transfusions!
Don t give artificial respiration!
Don t dilate the anus!

C **Therapeutic Tests**

1. Many anesthetists suspect cardiovascular collapse phenomena before cardiac arrest and therefore attempt to elevate the blood pressure and stimulate circulation by giving 0 2 cc 1% Neosynephrine, (2 mg) intravenously in 20 cc of Physiological Saline Solution Some add Atropine Sulphate 1/60 gr, (1 mg) to break up the vagal reflex. This test must be carried out within 1 minute **No more time should be allotted to it!**

2. **Cut skin and check for active (arterial) bleeding**

D **If abdomen is already opened—**

1. The surgeon should immediately feel under the left diaphragm for heart action Not infrequently gentle tapping of the ventricle will initiate heart action Unfortunately one cannot differentiate the various types of cardiac arrest from within the abdomen

E **THE MOMENT CARDIAC ARREST IS DIAGNOSED**—the following procedure is followed

1. **STOP ANESTHESIA! STOP SURGERY!**
2. **MAINTAIN RESPIRATORY EXCHANGE**
   a) Oxygenate patient—10-20 liters of Oxygen per minute, via intratracheal tube
   b) No undue pressure on breathing bag The respiratory rate should be 20 to 30 per minute
   c) Trendelenberg position 5 to 10 degrees maintains a better cerebral circulation and oxygenation.
3. **OPEN THORACIC CAGE**
   a) **Antero lateral Incision** is made in the 4th intercostal space (This area should always be routinely 'preped')
      1) **Look for bleeding! Don't open chest if bleeding is arterial!**
      2) **Slip gloved hand into chest**—and give heart several rhythmic squeezes Cardiac cycle may start immediately If heart action does not return, then cut the rib cartilages above and below and insert a self-retaining retractor
   b) **The pericardium should preferably be opened because direct inspection for diagnosis and treatment is thereby made possible A Diagnosis of Cardiac Standstill or Cardiac Fibrillation must be established before any definitive treatment can be undertaken**
   c) **Compression Rate** is between 60 and 80 per minute, the rhythmic compression of the heart should encompass both ventricles
      1) The anesthetist can tell whether an effective carotid and peripheral pulse is created

2) Cardiac Massage—has been applied with success for over 1 hour Massage Teams—alternating with each other may avoid undue fatigue

d) **CARDIAC STANDSTILL**—is treated as follows

1) Cardiac Massage—(as described above)

2) Adrenalin, 0 5 cc (1 1000) in 10 cc Physiological Saline Solution or Calcium Chloride, 2-5 cc of 10% solution injected directly into the right ventricle or pulmonary artery

3) Whole blood by rapid infusion (i e) hand pump

e) **VENTRICULAR FIBRILLATION**—is treated as follows

1) **Electrical Defibrillator**

a) A single shock across both ventricles usually suffices

b) Several shocks may have to be applied if one is unsuccessful

c) Good electrical contact with the myocardium is obtained when gauze moistened with physiological saline is used, *the latter insures effective passage* of electrical current through the myocardium (Avoid too weak stimulation, it may actually cause fibrillation!)

2) **Drug Defibrillators**—are employed when electrical

NOTES

defibrillation is unsuccessful

a) Procaine (10 cc of 1% solution)

b) Procaine amide, (Pronestyl) 100 to 200 mgs

F EFFECTIVE DRUGS USED IN CARDIAC ARREST

(1) **Fibrillating Heart**

a) Procaine amide (Pronestyl), (100-200 mgs) is a cardiac depressant, it is used if electrical defibrillation is unsuccessful

b) Procaine, 10 cc of 1% solution

c) KCl—I V (0 5% sol) can overcome ventricular fibrillation induced by electrical shock $CaCl_2$ increases myocardial contractility and may be used to overcome the standstill effect induced by Pronestyl

(2) **Heart in Standstill**

a) Epinephrine (adrenalin) 1 1000 0 5 cc in 10 cc Physiological Saline Solution **AVOID adrenalin where cyclo propane is being employed—it may precipitate fibrillation!**

b) Calcium chloride—2 5 cc of 10% solution

c) Some combine Pronestyl with Adrenalin to lessen tendency of Adrenalin to initiate cardiac fibrillation

d) Norepinephrine (Levophed) should not be used it may initiate ventricular fibrillation

NOTES

THIS CHART SHOULD BE POSTED IN EVERY OPERATING ROOM!!!

Prepared by CARDIAC SURGERY COMMITTEE,
SAN FRANCISCO HEART ASSOCIATION,
604 Mission Street, San Francisco 5, Calif
Modified after the Program of Los Angeles County Heart Association

PROGRAM OF ACTION—CARDIAC RESUSCITATION

ANESTHETIST

1. NOTIFY SURGEON IMMEDIATELY when pulse and blood pressure disappear
2. DO NOT WASTE TIME
3. DELIVER 100% OXYGEN IMMEDIATELY—(Breathing bag and mask)
4. ASK SURGEON to check pulses—palpatation of aorta, heart, carotid or any other major artery, **(a palpable pulse excludes ventricular fibrillation or cardiac standstill)**

SURGEON

1. **CARDIAC STANDSTILL,** (spontaneous function may recur at any step)
   - a) RHYTHMIC CARDIAC COMPRESSION—direct thoracotomy incision into 4th or 5th interspace, 50 to 60 times per minute, open pericardium
   - b) ATROPINE—1/50 grain in 10 cc Physiological Saline Solution—directly into ventricular cavity, (if of reflex or vagal origin)
   - c) CALCIUM CHLORIDE—next if necessary, 6-10 cc of 10% solution—directly into left ventricular cavity
   - d) EPINEPHRINE—next if necessary, 1 cc of 1 1000 diluted in 10 cc Physiological Saline—directly into left ventricular cavity
   - e) ISOPROPYLNOREPINEPHRINE—last resort—0 2 to 0 4 mg diluted in 10 cc normal saline solution directly into left ventricular cavity
2. **VENTRICULAR FIBRILLATION** (spontaneous function may recur at any step)
   - a) RHYTHMIC CARDIAC COM-

SURGEON

PRESSION—direct thoracotomy incision into 4th or 5th interspace, 50 to 60 times per minute, open pericardium

b) ELECTRO-SHOCK directly to heart —2 0 amperes, 110-130 volts, for 0 1-0 5 seconds (serial shock if necessary 5-6 times), open pericardium if necessary for good electrode contact

c) PROCAINE HCL—10 cc of 1% solution directly into left ventricular cavity

d) IF ASYSTOLE OR WEAK CONTRACTIONS occur after procaine injection—calcium chloride 2 4 cc of 10% solution or epinephrine 1 cc of (1 1000) diluted in 10 cc of Physiological Saline may be injected directly into left ventricular cavity, use **cautiously!**

e) TRENDELENBURG POSITION—5 to 10 degrees

f) ELECTROCARDIOGRAM for definite diagnosis if available **Do not wait.**

g) INTRAVENOUS FLUIDS AND BLOOD during cardiac massage and after restoration of heartbeat—if necessary Cautious use of pressor drugs after restoration of heartbeat

h) CLOSE OBSERVATION in the operating room

i) RESPIRATOR if breathing not resumed after restoration of heart beat

Rhythmic Cardiac Compression Must Continue Throughout the Entire Procedure (ABOVE PROGRAM MUST BE EXECUTED WITH THE PRECISION OF A FIRE DRILL)

DRUG TRAY

1. Epinephrine—1 cc of 1 1000
2. Isopropylnorepinephrine 0 2 to 0 4 mg (Isuprel, Aleudrine, Norisodrine)
3. Calcium chloride 10% solution
4. Atropine 1/50 grain
5. Procaine HCl—1% solution
6. Physiological Saline Solution —100 cc

STERILE INSTRUMENT PACKAGE

1. Defibrillator electrodes
2. Rib spreader (1)
3. Hemostats (6)
4. Medicine glasses—1 oz. (4)
5. Scalpel with blade
6. Scissors (1)
7. Forceps (2)
8. Syringes 10 cc (4)
9. Sponges
10. Hypodermic needles—18 x 1½ (2), 22 x 1½ (4)

INFORMATION REGARDING THE 'DEFIBRILLATOR' MAY BE OBTAINED THROUGH THE SAN FRANCISCO HEART ASSOCIATION

NOTES

VENOUS THROMBOSIS

There are two types of venous thrombosis 1) Thrombophlebitis and 2) Phlebothrombosis, or Bland Thrombosis These two conditions have one thing in common, namely, the presence of an intravascular clot otherwise they differ from each other in etiology, pathology signs and symptoms prognosis and treatment In 1937 (R W McNealy) wrote on "Bland Thrombosis" as follows

A Bland Thrombosis offers no evidence of obstruction to the venous flow and may occasion the slightest if any signs of infection such as a rise in temperature — So many factors are responsible for the rate of blood flow ,— large capillary beds make them reservoirs of stagnant blood ,— the contractions of muscles squeeze the veins contained within them and drive the blood on toward the heart —every advantage must be taken of graduated exercises and gravity to assist the return from parts below the heart level ,— the flow of blood in the veins toward the heart is also encouraged by an increase in the respiratory rate '—' prolonged narcosis is to be avoided,' "Emil Ries was one of the first to call attention to the necessity of early postoperative exercises (early ambulation) —dehydration should be combated both pre- and postoperatively— These same principles apply today

The signs and symptoms of phlebothrombosis are not constant One must constantly be aware of the close relationship of phlebothrombosis with vague pulmonary findings in the postoperative period (i e)

a) **Rapid pulse**—may occur in 25% of the cases
b) **Hemoptysis and friction rub**—may occur in 15% of the cases
c) **So called 'broncho pneumonia'**—developing in the postoperative period may be indicative of pulmonary atelectasis or embolism with infarction

NOTES

EMBOLISM

Fatal pulmonary embolism occurs more frequently in medical patients than in surgical patients The incidence of fatal postoperative embolism is approximately 1 in 1,000, or (0 1%) approximately 50% of the patients are under 50 years of age

In addition to the vascular clot (embolus), there are several other varieties of emboli

1 Fat Embolism
2 Bone Marrow Embolism
3 Air Embolism
4 Tumor Cell Embolism

1 **FAT EMBOLISM**—usually occurs as a result of trauma Globules of liquid fat make their way into the open venous channels of the bone, and are dispersed into the venous vascular system In most patients no serious effect follows, but not a small number show pulmonary fat embolism has caused serious occlusion of pulmonary vessels Fat Embolism may occur without trauma It is believed that certain chemical changes can occur in blood which cause demulcification and coalescence of chylomicrons into larger globules of fat Smaller globules of fat may traverse the capillary bed of the lungs and escape into the arterial vascular system and may cause death by coronary or cerebral vascular occlusion

2 **BONE MARROW EMBOLISM**—may occur after a bone fracture Cyanosis dyspnea and broncho-pneumonia following any bone injury should make one suspect the presence of a fat or bone marrow emboli

3 **AIR EMBOLISM**—occurs when air escapes into the venous vascular system and lodges in the chambers of the right heart Trapped air in the right heart may not allow the blood to enter the pulmonic circulation (Air Embolism has been reported during thyroid and radical neck surgery, as well as during intrauterine manipulations criminal abortions and tubal insufflations)

4 **TUMOR CELL EMBOLISM**—occurs when tumor cells enter the venous or arterial circulation and become lodged in the lung Tumor cells may circumvent the pulmonary circulation Batson—in (1940) demonstrated how tumor cell emboli make their way into the vertebrae of the spinal column via the vertebral venous system without first passing through the lung It has been demonstrated experimentally that tumor cells can pass from the pulmonary into the arterial circulation Stockholm surgeons have studied the blood from veins draining cancers of the colon stomach, breast and lung Specimens of the blood from these veins during surgery showed cancer cells in 59% of 107 cases operated Fisher and Turnball and Engel found cancer cells in blood drawn from the cubital veins of patients with

cancer Cancer cells are appearing with increased frequency in bone marrow biopsies aspirated from the sternum

PATHOLOGIC PHYSIOLOGY OF PULMONARY EMBOLISM

A large embolism obstructing either the right or left pulmonary artery does not necessarily cause death During pneumonectomy, the right or left pulmonary artery is usually ligated without any effect upon the heart or general circulation **However, a large embolism that completely obstructs the main pulmonary artery does produce immediate death by completely obstructing the outflow of blood from the right heart** Residual blood in the pulmonary vascular system continues to be discharged from the left heart for only a short while before the latter comes to an abrupt stop Cerebral anoxia leads to a loss of consciousness and failure of the respiratory center The coronary circulation cannot continue to support the heart when the aortic blood pressure drops This eventually leads to an increasing dilatation of the right heart and a complete cessation of circulation

NOTES

THROMBOPHLEBITIS

A DEFINITION

Inflammation of venous wall associated with an intravascular clot

B CLOTTING MECHANISM

1 Mechanical trauma to vessel wall
2 Invasion of perivenous lymphatics by bacteria or toxins
3 Chemical injury

C CLOT

Endothelial injury results in clot formation The clot is firmly attached to the vessel wall with little tendency to dislodge (embolism)

D CLINICAL MANIFESTATIONS

Inflammation of the venous wall gives rise to impulses that reflexly transfer over to the sympathetic nerves of the ipsilateral arterioles A profound spasm takes place, resulting in pain edema disability and pallor

E ETIOLOGY

1 Predisposing Factors
   a) Operative and obstetrical procedures
   b) Trauma
2 Precipitating Factors
   a) Venous Stasis
   b) Infectious process

PHLEBOTHROMBOSIS
(Bland Thrombosis)

A DEFINITION

An intravascular clot unassociated with venous wall inflammation

B CLOTTING MECHANISM

1 Alterations in plasma and cells of the blood
2 Venous stasis leading to increased clotting tendency

C CLOT

Coagulation alone results in a clot that is unassociated with inflammation The clot is loosely attached with a great tendency to separate and result in pulmonary embolism

D CLINICIAL MANIFESTATIONS

Because no inflammatory reaction occurs, no arteriolar spasm takes place Hence, little or no signs and symptoms appear, (Veins are not contracted by spasm)

E ETIOLOGY

1 Predisposing Factors
   a) Certain persons are "thrombosers'
   b) Tissue destruction by neoplastic invasion or infection
2 Precipitating Factors
   a) Inactivity of the lower extremities with relaxation of the calf

muscles results in venous stasis

b) **Tight abdominal binders** cause undue pressure on the Inferior Vena Cava with resultant venous stasis

d) **Circulatory retardation** brought about in elderly patients by cardiac disease Medical confinement favors venous stasis

e) **Dehydration** favors venous stasis and clotting

f) **Chemical changes**—in the blood frequently affects the clotting mechanism

g) **Enzymatic**—action

F CLINICAL MANIFESTATIONS

1 Symptoms and Signs

a) Temperature	Increased
b) Pulse	
c) Respiration	
d) Leucocytes	
e) Pain	
f) Coldness	
g) Swelling	
h) Pallor	

Manifestations are due to *vasoconstriction* and are obviated by vasodilatation If adequate treatment is not undertaken the following **post phlebitic sequelae** may persist

1 Edema (Deep venous obstruction)

2 Ulceration (Trophic skin changes)

3 Varicosities (Compensa

F CLINICAL MANIFESTATIONS

1 Symptoms and Signs

a) **Lautre's Sign**—slight elevation of temperature

b) Elevation of the pulse rate out of proportion to the temperature

c) Sedimentation rate increased

d) **Allen's Sign**—Consists of—a) and b)

e) **Homan's Sign**—pain in calf muscles or popliteal area with forceful dorsi flexion of foot

tory circulation)
4) Recurring erysipeloid infections, (Poor skin resistance)

G TREATMENT

1 PROPHYLACTIC TREATMENT (same for either form of venous thrombosis)

a) ATRAUMATIC SURGICAL TECHNIC
1) Sharp dissection, never use the handle of the knife
2) Fine non absorbable sutures
3) Observation of 1) and 2), will result in a minimum of tissue trauma with minimal liberation of thrombokinase or clotting factor

b) MEASURES TO ACCELERATE VENOUS RETURN FROM THE LOWER EXTREMITIES
1) Early ambulation
2) Active mobilization of lower limbs, (leg exercises, i e, bicycling and kicking in bed)
3) Deep breathing exercises
4) Warmth to extremities
5) Compression bandages (Elastic Bandages) are applied routinely to extremities in patients over 65 years
6) Alcoholic stimulation digitalis quinidine, and diuretics for cardiacs
7) Prolonged narcosis and sedation must be avoided

c) PROPHYLACTIC MANAGEMENT OF "KNOWN THROMBOSERS"
1) Heparin and Dicumarol employed for 2-3 weeks post-operatively Do daily Prothrombin Time studies
2) Observe all measures that accelerate venous return from the lower extremities

d) ADEQUATE HYDRATION
1) Maintenance of daily water-balance

2 ACTIVE TREATMENT OF THROMBOPHLEBITIS

a) REGIONAL LUMBAR SYMPATHETIC GANGLIA BLOCK
1) 5 cc of 1% Procaine Hydrochloride injected into each of the 4 lumbar ganglion sites on the involved side
2) Repeat procedure daily until patient is temperature free
3) Patient is allowed up in 7-10 days
4) Treatment should produce immediate relief

b) ANTI COAGULANT TREATMENT
1) Preoperative basal Prothrombin Time (Quick Method) and Coagulation Time (Lee-White Method)
2) Heparin—300 400 mgs I V in divided dosage in 24

sulted in failure in 10 out of 167 cases—6% This figure is as high as untreated cases of phlebothrombosis

3 **Riddell and Kirby**—reported on 14 cases of Inferior Vena Cava ligations
   a) In one case an embolism was dislodged during the operation
   b) Operative mortality was 28%
   c) Postoperative sequelae were edema, swelling of both lower extremities and skin ulcerations
4 **Veterans Hospital in Long Beach, California**
   a) 25 of 59 patients operated on for femoral vein ligations showed evidence of disabling sequelae 1 year later
   b) Patients receiving anti-coagulant therapy alone showed no disturbing late sequelae
   c) Prophylactic femoral vein ligations have almost been abandoned
5 **Mayo Clinic**
   a) Barker et al reports on 180 cases of non-fatal pulmonary embolism treated by anti-coagulant therapy
   b) 1 1% of these cases developed subsequent embolic phenomena, 50% of which subsequently proved fatal
6 **Charity Hospital in New Orleans**
   a) 70 patients had superficial femoral vein ligations after an initial non fatal embolism occurred
   b) In 12 cases—bi lateral superficial femoral vein ligation failed to save the patient's life *
      1) In 2 cases—emboli originated in the heart
      2) In 2 cases—emboli originated in the pelvic veins
      3) In 1 case—thrombosis developed on the proximal side of the ligature
      4) In 3 cases—the ligature level was below the clot level
      5) In 1 case—the ovarian veins were not ligated after the Inferior Vena Cava was interrupted
      6) In 3 cases superficial femoral vein interruption was too late
7 **Massachusetts General Hospital**
   a) Roe and Goldthwait report on 1900 cases receiving superficial femoral vein ligations
      1 50% were carried out as prophylactic measures
      2 50% were done as therapeutic measures
   b) 26 patients receiving bi-lateral femoral vein ligation died of pulmonary embolism **
   c) 5 patients receiving prophylactic superficial femoral vein ligation died of pulmonary emboli arising from a thrombus at the site of ligation

*The authors are of the opinion that anti-coagulants have a very limited use Definite indications are difficult to define

**The presence of Homan s Sign does not necessarily exclude the co-existence of thrombi in the iliac hypogastric vesical ovarian periprostatic or uterine veins neither does it exclude the Inferior Vena Cava and the right heart

   d) The operative mortality on patients receiving superficial femoral vein ligations was 5 in 1,000
8. **Crutcher and Daniel**
   a) 11 of 55 cases (20% showed clinical evidence of phlebitis preceding fatal pulmonary embolism
   b) 6 of the 11 cases—had thrombosis in the iliac veins or higher
      1. Bi lateral femoral vein ligation in these 6 cases would not have prevented pulmonary embolism
   c) 44 of 55 cases, (80%), showed no evidence of phlebothrombosis
      1. No treatment could have been instituted
9. **Baylor University in Houston Texas**
   a) De Bakey is of the same opinion as the authors, namely that anticoagulants and venous ligations have a limited value in the prevention or treatment of phlebothrombosis, (bland thrombosis)

SUMMARY

1. Operative interference for prevention of pulmonary embolism has proved disappointing
2. Some believe prophylactic operative measures may have even increased the incidence of pulmonary embolism
3. Best hope for lowering the incidence of phlebothrombosis (phleboembolism) is by observing **all** the measures listed under VENOUS THROMBOSIS, PROPHYLACTIC TREATMENT
4. Cortisone (or any of its derivatives), is contraindicated wherever phlebothrombosis is suspected or being treated **This drug may cause a fixed thrombus to loosen and detach itself**

NOTES

POSTOPERATIVE PAROTITIS

I DEFINITION

Parotitis is an acute inflammatory condition involving one or both parotid glands

II ETIOLOGY—not known

A Possible causative factors

1 Retrograde extension of infection from mouth to the gland along Stenson's duct

2 Blood borne infection, (embolic)

B Contributing factors

1 Dryness of mouth, (Pre- and postoperative)

a) Oral fluids interdicted

b) Dehydration

2 Oral Sepsis

3 Debilited and aged patients, (parched oral mucous membranes)

III DIAGNOSIS—is made on

A Signs and Symptoms

1 Swelling pain and tenderness of gland at angle of the jaw

2 Systemic intoxication

a) Temperature as high as 106°F

b) Pulse—rapid

c) Leukocytosis—increased, especially in suppurative parotitis

3 Fluctuant areas may be palpated in suppurative parotitis

4 Expression of pus from Stenson's duct

IV TREATMENT

Recognition and treatment of early signs and symptoms of parotitis may avoid serious complications

A Prophylactic

1 Oral sepsis treated preoperatively

a) H_2O_2 mouth washes

b) Antibiotics (local and systemic)

2 Improve general nutrition of patient pre- and postoperatively

3 Overcome dehydration pre- and postoperatively

4 Postoperatively—encourage mouth washing gum chewing and candy sucking to promote continuous salivary secretion

B Active Treatment

1 Early Parotitis

a) Apply warm or cold compresses

b) Antibiotics or/and sulfonamides (choice of surgeon)

c) Oral hygiene

1) Mouth washes q hourly

2) Encourage salivary secretion by allowing oral fluids

candy sucking or gum chewing postoperatively

d) Irradiation Therapy may be of greatest value only when administered within the first hours of the disease onset
   1) **X Ray** often brings about quick and effective relief of pain, swelling and the possible prevention of abscess formation Recommended dosage in 1 sitting deliver optimum dosage (½ skin erythema dose)
   2) **Radium**—dosage varies from 1000 6000 mg/hrs, depending on severity, 2-4 mg tubes of Radium 1 inch apart, use filtration of 2 mm lead, 1 mm brass and 0 5 mm silver

2 **Late Parotitis**
   a) **Surgery**
      1) **Incision and drainage must be adequate** Multiple incisions may be required
      2) Fluctuation is difficult to palpate because of gland s fibrous septa and thickened tense capsule
      3) Needling gland (15 gauge needle) at suspected site may reveal the presence and site of pus
      4) When pus is suspected or proved—incision and drainage must be carried out without delay
      5) Needling and Incision procedures should avoid injury to the facial nerve The latter may be destroyed by the infectious process
      6) **Anesthesia**
         (a) **Local**—carried out in main O R with the Anesthesiologist standing by with all his emergency equipment
         (b) **General**—intubation is mandatory—especially when bi-lateral parotitis and marked neck swelling co-exist
      7) **Chemotherapy**
         (a) May resort to antibiotic combinations both locally and systemically Culture and sensitivity studies are indicated
         (b) Blood and plasma when indicated
         (c) Fluid and Electrolyte balance must be maintained at all times
   b) **General Nutritional Care**
      1) Hi-protein—Hi carbohydrate—Hi mineral diet
      2) Multivitamins (oral I M and I V)
      3) Special diet when indicated

THE USE OF (ACTH) CORTICOTROPIN, CORTISONE AND HYDROCORTISONE IN GENERAL SURGERY

GENERAL

During surgery, the adrenal cortex is activated through hypothalamic-pituitary-adrenocortical stimulation to secrete greater quantities of steroidal hormones, i e hydrocortisone and cortisone This response diminishes within 7 days postoperatively and can be demonstrated by a declining urinary output of 17 hydroxycorticoids It is believed that the increased output of hydrocortisone by the adrenals during stress of surgery serves a beneficial purpose and that the administration of artificial adrenal hormone can effectively reproduce the same favorable response Approximately 40 steroids thus far have been isolated from the adrenal cortex but only 2 are therapeutically effective, namely, **CORTISONE** and **HYDROCORTISONE**

ACTH, Cortisone and Hydrocortisone may be employed in the pre- and postoperative management in select instances, with great benefit to the patient

(ACTH) CORTICOTROPIN is a polypeptide derived from the pituitary glands of animals which stimulates the adrenal cortex to produce Hydrocortisone The physiological action of Hydrocortisone and Cortisone are

A DESIRED PHYSIOLOGICAL EFFECTS

1 Sustains life in the absence of the adrenal glands
2 Anti inflammatory action
3 Anti-allergic and Anti endotoxic action
4 Sustains blood pressure
5 Retains sodium promotes loss of potassium
6 Neuromusculotonic Antipyretic, Euphoretic

B UNDESIRABLE PHYSIOLOGICAL EFFECTS

1 By decreasing inflammatory response prevents effective localization of infection
2 By interfering with fibroplasia it prevents healing of wounds
3 May induce a Negative Nitrogen Balance
4 By promoting a greater loss of urinary potassium it induces edema hypertension and weakness
5 Produces transient Hyperglycemia and Glycosuria through Insulin antagonism and increased gluconeogenesis
6 On occasion, insomnia and psychosis, menstrual irregularities and hypothyroidism

The undesirable physiological effects can be altered or modified by the following precautions

1 **Initial high** dosage and gradual reduction within 7 days (unless steroid maintainance is essential)
   a) **Cortisone or Hydrocortisone**
      100-300 mgs /daily

b) Dosage should eventually compare to normal adrenal cortical output, i e 25 mg Cortisone daily, or 10 units Corticotropin gel/daily, (ACTH)

2 **Salt (NaCl) restriction**

3 **Supplemental Potassium Intake**

a) Unless renal output is impaired, give 6-8 Gms oral KCl daily

4 **High Protein Diet**

a) To counteract negative nitrogen balance

5 **Insulin**

a) Give small dose if glycosuria (4+) persists

NOTES

THE USE OF (ACTH) CORTICOTROPIN, CORTISONE AND HYDROCORTISONE IN GENERAL SURGERY

GENERAL

During surgery the adrenal cortex is activated through hypothalamic-pituitary-adrenocortical stimulation to secrete greater quantities of steroidal hormones, i e hydrocortisone and cortisone This response diminishes within 7 days postoperatively and can be demonstrated by a declining urinary output of 17 hydroxycorticoids It is believed that the increased output of hydrocortisone by the adrenals during stress of surgery serves a beneficial purpose and that the administration of artificial adrenal hormone can effectively reproduce the same favorable response Approximately 40 steroids thus far have been isolated from the adrenal cortex, but only 2 are therapeutically effective, namely, **CORTISONE** and **HYDROCORTISONE**

ACTH Cortisone and *Hydrocortisone* may be employed in the pre- and postoperative management in select instances, with great benefit to the patient

(ACTH) CORTICOTROPIN is a polypeptide derived from the pituitary glands of animals which stimulates the adrenal cortex to produce Hydrocortisone The physiological action of Hydrocortisone and Cortisone are

A **DESIRED PHYSIOLOGICAL EFFECTS**
1 Sustains life in the absence of the adrenal glands
2 Anti inflammatory action
3 Anti allergic and Anti endotoxic action
4 Sustains blood pressure
5 Retains sodium, promotes loss of potassium
6 Neuromusculotonic Antipyretic Euphoretic

B **UNDESIRABLE PHYSIOLOGICAL EFFECTS**
1 By decreasing inflammatory response prevents effective localization of infection
2 By interfering with fibroplasia it prevents healing of wounds
3 May induce a Negative Nitrogen Balance
4 By promoting a greater loss of urinary potassium it induces edema hypertension and weakness
5 Produces transient Hyperglycemia and Glycosuria through Insulin antagonism and increased gluconeogenesis
6 **On occasion,** insomnia and psychosis menstrual irregularities and hypothyroidism

The undesirable physiological effects can be altered or modified by the following precautions

1 **Initial high** dosage and gradual reduction within 7 days (unless steroid maintainance is essential)
   a) **Cortisone or Hydrocortisone**
      100-300 mgs /daily

INDICATIONS FOR USE

The indications for the use of Hydrocortisone, Cortisone and ACTH are the same—except that ACTH must not be used where

1 ADRENAL INSUFFICIENCY OR HYPOPITUITARISM EXIST
2 ADRENAL CORTICAL SUPPRESSION EXISTS DUE TO CORTISONE OR HYDROCORTISONE THERAPY
   NOTE ACTH CAN ONLY EXERT ITS INFLUENCE ON A RESPONSIVE ADRENAL CORTEX

The physiologic function of ACTH (adreno-corticotropic hormone) is to stimulate the adrenal cortex to secrete several steroids having both anabolic and catabolic effects Individual adrenal glands respond differently to a given therapeutic dose and therefore the response is not always predictable The physiologic effects of a given dose of Cortisone or Hydrocortisone are specific and therefore a therapeutic response is more dependable Rapid absorption of Cortisone and Hydrocortisone make them effective when given orally ACTH is slower acting and less predictable than Cortisone and Hydrocortisone **The latter 2 hormones produce secondary adrenal suppression** by inhibiting the pituitary s output of endogenous ACTH **ACTH stimulates the adrenal cortex** to produce endogenous Hydrocortisone, the latter in turn secondarily suppresses the pituitary's output of endogenous ACTH The abrupt cessation of ACTH administration does not result in sudden and severe symptoms of adrenal insufficiency as occurs with the sudden withdrawal of Cortisone and Hydrocortisone **One should be cautioned against abruptly discontinuing either preparation after prolonged periods of treatment** Hydrocortisone is more soluble and its action is about twice as rapid as Cortisone It is however shorter acting and must be replenished q 4 hrs

NOTE HYDROCORTISONE ACETATE—being insoluble is especially suited to intra-articular injection

A SPECIFIC INDICATIONS

1 ADRENO CORTICAL, (CORTISONE) REPLACEMENT THERAPY
   a) Bi-lateral Adrenalectomy
   b) Adrenal Insufficiency
   c) Pituitary Deficiency (Hypopituitarism)
      (See Pre- and Postoperative Orders for Surgery of the Adrenal Gland)
2 ADRENO CORTICOTROPHIC (ACTH) REPLACEMENT THERAPY
   a) **Hypofunctioning Adrenal states**
      1) Cushing s Syndrome
   b) **Hypofunctioning Adrenal Neoplasm**
      1) Adenomas
      2) Carcinomas

PREPARATIONS

1 **CORTISONE**—(Cortisone Acetate, Cortone)
   a) **Crystalline suspension in aqueous solution,** (25 mgs /cc), used **intramuscularly**
      Dosage Usually 50 to 100 mgs q 6 to 24 hrs
   b) **Tablets,** 25 mgs **orally**
      Dosage Usually 50 to 100 mgs q 6 to 24 hrs
2 **HYDROCORTISONE**—is more soluble than Cortisone and acts more rapidly, may be given **intravenously** Solu-Cortef is used I V
      Dosage Tablets 5 to 20 mgs —given q 6 hrs , orally 100 mgs added to 500-5% Dextrose in water or physiological saline Rate 25-50 mg q hourly
3 **ACTH (ADRENO CORTICOTROPIN)**
   a) Lyophilized or in aqueous solution
   b) Corticotropin gel—used intramuscularly, 20-80 units daily

NOTES

ANTIBIOTICS IN SURGERY

The majority of bacterial infections can now be controlled successfully with antibiotics Some viral, rickettsial, and protozoan diseases also respond favorably to them THE SURGEON MUST NOT OVERLOOK THE FACT THAT ANTIBIOTICS CANNOT SUPPLANT ASEPTIC TECHNIC AND METICULOUS SURGICAL CARE, NOR WILL THEY EVER SUCCESSFULLY OVERCOME PERITONITIS RESULTING FROM CONTINUOUS LEAKAGE OF A VISCUS Only by rational use of antibiotic agents can we make them more valuable and lasting adjuncts to surgery

Meleney classifies bacterial infections into medical and surgical categories, and recommends anyone of 3 modes of antibiotic administration

1 Systemic antibiotic administration,
2 Local antibiotic administration or
3 Combined mode of administration

Meleney stresses that the surgeon must be able to first recognize the fundamental differences between **medical** and **surgical** infections before he can intelligently manage a surgical infection

A **MEDICAL INFECTIONS**—are characterized by a diffuse cellulitis of the organ involved and are not usually associated with local tissue destruction It becomes apparent then that medical infections cannot be treated locally but rather they must be treated by some agent that can effectively permeate all the tissues of the body and reach all areas of infection through patent and dialated blood vessels

B **SURGICAL INFECTIONS**—are usually characterized by the local extent of the disease accompanied by a local breakdown of tissue or a local collection or exudate Here then is a condition that can be treated successfully by local as well as systemic treatment Medication can often be delivered locally to an infected area when it cannot reach the area via the systemic route because of thrombosis of blood vessels in the periphery of the lesion This type of local infection can best be controlled by bringing the antibacterial agent into direct contact with the infecting organisms in higher concentration that can be attained by systemic administration

The local effectiveness of sulfonamides and antibiotics or any other bacterial agent is limited by

1 SOLUBILITY in body fluids
2 DIFFUSIBILITY from the vehicle
3 INHIBITION by dead tissue, pus blood or products of tissue disintegration
4 INACTIVATION by bacterial contaminants
5 Susceptibility or resistance of the causative organism

3 ANTI INFLAMMATORY THERAPY
a) Ulcerative Colitis
b) Regional enteritis, (Terminal Ileitis)
c) Bacterial Endocarditis, (Mitral Stenosis) (See—Orders for Cardiac Surgery)

4 THROMBOPHLEBITIS—(See chapter on Thrombophlebitis and Phlebothrombosis) *

5 ALLERGIC CONDITIONS
a) Drug or food allergy
b) Transfusion reactions
c) Serum sickness

B CONTRAINDICATIONS TO THE USE OF ACTH AND CORTISONE

1 TUBERCULOSIS—(active)
a) *Cortisone and ACTH may interfere with the walling off or* fibroplastic process of healing

2 ESSENTIAL HYPERTENSION, (MALIGNANT)
a) Cortisone and ACTH may aggravate hypertension through salt retention

3 UREMIA
a) Corticosteroids favor retention of Non-Protein Nitrogen

4 PEPTIC ULCERATIONS, (ACTIVE)
a) HCl, pepsin and trypsin secretions are increased, this may predispose to perforation and/or hemorrhage

C EXTREME CAUTION MUST BE OBSERVED IN THE FOLLOWING CONDITIONS

1 Acute Infections
a) Active tuberculosis and superimposed infections of low virulency such as with Pyocyaneus and Staphylococcus Aureus

2 Wound Healing
a) This is no serious problem when the dosage is graduated downwardly in from 7 to 10 days

3 Edema
When sodium loss and potassium loss are accentuated, conditions of muscular weakness hypertension and edema become aggravated

4 Hyperglycemia and Glycosuria
a) Diabetes Mellitus offers no serious contraindication when Insulin requirement is increased
b) In non-diabetic conditions with glycosuria caused by decreased renal threshold, the anti-insulin effect of ACTH and Cortisone may be counteracted with small dosages of Insulin.

*Where *Phlebothrombosis* is suspected—Corticosteroids should be avoided! Cortisone and Hydrocortisone by decreasing fibro-plastic activity may predispose to clot detachment with resultant fatal pulmonary embolism

reaction than do small caliber catgut sutures, inflammatory tissue reaction invariably invites bacterial growth

5 Sutures that are too closely placed and tied too tightly jeopardize the vitality of sewn tissues, and invite necrosis, infection and leakage

6 A surgeon who constantly "paws", piddles', 'titilates' and otherwise "manhandles" tissue, invites inflammatory tissue reaction that ultimately leads to infection

NOTES

According to Meleney* the five criteria for effective use of antibiotics in surgical infections are

1 If surgery can be obviated
2 If surgery can be limited
3 If time of infection can be shortened
4 If a primary closure can be done after surgery
5 If an earlier secondary closure can be accomplished

The surgeon with the aid of the bacteriological laboratory tries to ob tain the desired information before he proceeds to treat the infection with an agent or combination of agents best suited to the case

If the infectious process is local without any evidence of generalized spread, it can best be treated locally If there is evidence of a spread to surrounding tissue or generalized dissemination, then a systemic form of drug administration should also be employed

PREVENTION OF SURGICAL INFECTIONS

Constant vigilance by the Surgical Staff against breaks in aseptic technic will materially reduce surgical infections that originate in the operating room and at the bedside of the patient We believe that **carelessness** not ignorance of **aseptic surgical principles** is primarily responsible for surgical infections

Some of the more **common "Breaks in Technic" that originate in the operating room** and at the bedside that ultimately lead to postoperative infections are

1 Faulty and hasty hand scrubs
2 Failure of surgical cap to completely cover hair
3 Failure of mask to cover nose completely
4 Careless coughing and sneezing.
5 Unobserved nicks and tears in rubber gloves
6 Instrument nurse indiscriminately handling 'dirty sponges, in struments and tissue specimens
7 Failure to immediately discard instruments and other objects of dubious sterility

Some of the more **common "Breaks in Technic" that usually originate with the Surgeon** himself and which ultimately predispose to tissue infec tions are

1 Operating with a dull scalpel or dissecting with its handle, will severely traumatize and devitalize tissue Devitalized tissue often predisposes to faulty healing infection phlebothrombosis and pulmonary embolism
2 Undue traction, particularly sharp retraction, will unduly damage the tissues and invite infection
3 Crude wiping instead of gentle sponging of tissue serves as a cumulative source of minimal trauma
4 Large caliber catgut sutures induce more inflammatory tissue

*A personal communication from Dr Frank L Meleney to Dr Jacob A Glassman

a) More time is required for effective bowel sterilization

4 Neomycin and Aureomycin

a) Aureomycin is absorbed from the G-I tract and is only bacteriostatic

J Cohn, (Am J Gastroenterol 28 298,1957), makes the following recommendations

In the preparation of patients for colon surgery, these antibiotics have given best results combinations of nystatin and neomycin sulfathaladine and neomycin, and tetracycline and neomycin Less effective were chloramphenicol combined with neomycin, and a combination of Terramycin and neomycin

V ANTIBIOTIC MIXTURES

The question as to whether or not superior antibacterial action can be attained with antibiotic combinations often comes up Though many clinical and in vitro studies have been carried out, no conclusive results are yet available Drug houses have marketed many antibiotic combinations with claims of superiority of two antibiotics over either of the drugs alone There are surgeons who believe that antibiotic combinations should be employed for the following reasons

1 To obtain a more rapid and better therapeutic result that cannot be attained by either antibiotic alone, (Synergism)
2 To achieve a more rapid and better therapeutic result with nontoxic doses of two antibiotics that would otherwise require a toxic dose of either antibiotic alone
3 To prevent or delay the development of resistant strains of bacteria during treatment
4 To treat a mixed infection where a single antibiotic s bacterial spectrum is not wide enough against all existing organisms
   IN SURGICAL INFECTIONS, MIXTURE OF ANTIBIOTICS ARE OFTEN INDICATED BECAUSE THERE IS A MIXTURE OF ORGANISMS WHICH ARE SYNERGISTIC *
5 To start treatment on seriously ill patients before a bacterial study can be completed

We believe that at the present time there are frequent benefits derived from antibiotic combinations Few antibiotics have a true synergistic effect with one another The following combinations of antibiotics are believed to possess some degree of synergism

1 The combination of Streptomycin Isoniazid and Paraminosalicylic Acid (PAS) is employed frequently in the treatment of Tuberculosis
2 The mixture of Streptomycin or Dihydrostreptomycin and Penicillin (Combiotic) is often employed in peritoneal and endocardial infections

*A personal communication from Dr Frank L Meleney to Dr Jacob A Glassman

GENERAL CONSIDERATIONS ON THE USE OF ANTIBIOTICS

I "Many physicians seem to have forgotten that nature provides the first, and often the best line of defense against infection Unless physicians quickly adopt a more critical attitude, there is real risk that antibiotics might prove more of a curse than blessing" (O L S Scott, J A M A 165, 2216, 1957)

II ROUTINE PREOPERATIVE USE OF ANTIBIOTICS

- A Most surgeons do not recommend the routine use of antibiotics in clean cases
- B Many surgeons believe that routine employment of antibiotics may lead to lower standards in surgical technic
- C In suspect and infected cases it is wise to employ antibiotics preoperatively In brain, cardio vascular and certain gastrointestinal surgical procedures the preoperative use of antibiotics is an acceptable precaution

III LOCAL USE OF ANTIBIOTICS DURING SURGERY

- A Intraperitoneal instillation of antibiotics where local or general peritonitis exists is considered good local use of antibiotics We often employ Streptomycin 1 gm combined with Penicillin 1,-000 000 u in 2-4 ounces of Physiological Saline Solution
- B Penicillin plus Streptomycin is believed to be a synergistic combination, i e, together they exert a greater bacteriocidal effect than either one alone
- C Instillation of antibiotic into an open infected wound has become accepted practice
- D In bowel sterilization we are concerned with antibiotics that are not absorbed from the alimentary tract and are bactericidal In bowel surgery we are particularly concerned with the following colonic organisms
  1. Esch Coli*
  2. Proteus Vulgaris*
  3. Cl Welchii**
  4. Non-Hemolytic Streptococci (Swallowed from naso pharynx)

IV EFFECTIVE ANTIBIOTIC COMBINATIONS—not inactivated by intestinal organisms are

1. Neomycin and Bacitracin
   a) An ideal combination
2. Neomycin and Streptomycin
   a) Colonic organisms may quickly develop resistance to streptomycin
3. Neomycin and Sulfasuxadine

*Esch Coli and Proteus Vulgaris are best treated with Neomycin
**Cl Welchii and Non hemolytic streptococci are best treated with Bacitracin

ANTIBIOTICS

I **PENICILLIN***—is almost without toxicity, except in certain cases where an idiosyncrasy exists The dermatologists find that sensitivity to Penicillin often develops after prolonged external application of Penicillin ointment Penicillin's chief limitation is its destruction by Penicillinase, an inactivating ferment produced by Coliform organisms and some resistant strains of Staphylococci Penicillin is not inhibited by necrotic tissue, pus or blood, and in solution is highly soluble and diffusible When Penicillin in a water soluble vehicle is introduced locally, it will be absorbed through the wall of the local lesion and exert its antibacterial action An aerosol of Penicillin has been successfully used in the treatment of acute and chronic pulmonary infections

Clinical experience has shown that large doses of Penicillin may be ineffective in subduing an infection, even though sensitivity tests have revealed the organism in question to be sensitive to Penicillin in vitro

Eagle** drew attention to the fact that Penicillin destroys bacteria in vitro when they are actively metabolizing in a favorable medium He further suggested that in older infections the organisms have multiplied to the extent that all nutrilites have become exhausted faster than they could be supplied by the blood Bacterial metabolic activity is further reduced by local inflammation in which leukocytes compete with bacteria for the nutrilites Bacterial growth is further reduced by the accumulation of end products toxic to their metabolism Eagle therefore believes that exhaustion of favorable nutrilites explains the paradoxical failure of treatment with Penicillin The author believes the physiological state of the organism, not the concentration of Penicillin to be the limiting factor in the refractory state For more successful therapy **Eagle recommends prolongation of treatment with Penicillin or Penicillin in combination with another antibiotic whose effectiveness is not restricted to actively metabolizing bacteria**

*In 1928 Alexander Fleming at St. Mary s Hospital London discovered a contamination of a culture plate of staphlococci by spores of a species of penicillium mold In 1929 Fleming suggested the use of his anti bacterial penicillium filtrate against "Penicillin sensitive microbes. Raistrich in 1930 successfully grew penicillium mold on Czapek Doxmedium Thorn Raper and Reid studied and reported on the inhibitory substance produced by the penicillium mold Chain and Florey of Oxford in 1940 confirmed Fleming s findings and were the first to isolate powdered Penicillin in an impure form. Prof Ernst B Chain in a letter to M D magazine Jan 1959 stated E B Chain who jointly with H W Florey initiated in 1938 the work on antibiotics at Oxford which led to the discovery of the curative properties of penicillin and directed the chemical investigations

**Eagle H "Experimental Approach to the Problem of Treatment Failure with Penicillin Am J Med 13 389 1952.

3 Penicillin and Bacitracin in Endocarditis is considered an effective mixture

4 Polymyxin-B and Bacitracin combination has definite value in local skin infections

5

Neomycin and Bacitracin* Erythromycin and Bacitracin Neomycin and Aureomycin Neomycin and Streptomycin	All effectively lower the intestinal bacterial flora

6 Steptomycin in combination with a Tetracycline or Chloramphenicol has shown superior results in the treatment of Brucello-sis

*A personal communication from Dr Frank L Meleney to Dr Jacob A Glassman

NOTES

Clostridial organisms* (plus polyvalent gas serum)
Gonococci*
Meningococci*
B Anthracis*
T Pallidum (Syphilis)* (plus arsenicals, bismuth, etc)
T Pertenue (Yaws)
Actinomyces*
B Diptheriae* (plus diptheria anti toxin)

*Penicillin is considered the drug of first choice

NOTES

A PENICILLIN ANAPHYLAXIS

Three general types of reaction due to Penicillin hypersensitivity have been reported

1 Anaphylactoid-like shock-syndromes
2 Dermatological reactions
3 Serum-sickness-like reactions

We believe that shock reactions resulting from Penicillin injections are more frequent than the occasional reports would imply The continued promiscuous use of Penicillin will doubtlessly sensitize more and more people A more critical evaluation of the indications of Penicillin is urged We question all patients who are to receive Penicillin about their sensitivities and past experience with the drug Where a question of hypersensitivity exists, skin testing is recommended If a hypersensitivity exists we prefer to employ another antibiotic The histamine-like reaction of Penicillin has suggested the use of Anti histaminic compounds, (i e) Benadryl Chlor-trimeton and Pyribenzamine, the latter have appreciably lessened the undesirable symptoms of Penicillin reactions ACTH, Cortisone and Hydrocortisone have been successfully employed in severe Penicillin reactions

B **PENICILLIN ANAPHYLAXIS MAY BE FATAL** It has occurred with sufficient frequency to warrant **routine questioning for hypersensitivity and skin testing when necessary** It must be remembered that even skin testing for Penicillin sensitivity is not without danger of anaphylactoid shock It has been estimated that more than 1,000 deaths from **anaphylactic reactions to Penicillin** have occurred in the United States alone V M Smith (New England J Med 257 447, 1957) recommends the following method of testing for hypersensitivity to Penicillin Make a skin scratch (3 to 4 mm) with a hypodermic needle so as to penetrate only the outer skin layer Apply one drop of Penicillin solution (300 000 units per ml) Place another drop of this solution upon the lower eyelid Observe the test sites for 20 min Sensitivity in the skin is indicated by the appearance of a wheal, itching and redness, on eyelid look for itching watering redness and edema

We strongly recommend that Adrenalin 1 1000 be available at all times Dose 0 5 cc immediately and repeat if necessary, (hypo)

C **PENICILLIN** *is indicated* in infections caused by the following organisms

Hemolytic and Non hemolytic Streptococci*
Anaerobic Streptococci*

*Penicillin is considered the drug of first choice

3 Auditory impairment, (Tinnitus-Deafness)
  a) Adjust dosage or discontinue drug
  b) Audiometric readings before and after administration in select cases

STREPTOMYCIN—is indicated in infections caused by the following organisms
  B Tularense
  Tubercle Bacillus (plus Paramino-Salicylic acid (PAS), or/and Isoniazid)
  Esch Coli (plus Penicillin in peritonitis)
  H Influenzae
  H Pertussis
  K Pneumoniae (Friedlander s Bacillus)
  A Aerogenes
  Ps Aeruginosa (B Pyocyaneus)
  H Ducreyi (B Ducrey)

DIHYDROSTREPTOMYCIN—is closely related to its parent Streptomycin Its antibacterial spectrum is similar to Streptomycin, its neurotoxicity is believed to be less during short term therapy Dosage is the same as for Streptomycin **Do not administer Dihydrostreptomycin intravenously!**

NOTES

II **TYROTHRICIN***—is isolated from Bacillus Brevis and contains two factions Gramicidin and Tyrocidin Tyrothricin exerts a local antibacterial action against a large number of organisms Tyrothricin should not be given via subcutaneous or intravenous route because it induces hemolysis However, it may be used in an isotonic suspension containing 500 micrograms/cc Tyrothricin like all antibiotics is more effective when it comes in direct contact with the offending bacteria Anaerobic gram positive bacteria are most susceptible to its action Tyrothricin is more effective in acute infections, especially in streptococcic ulcerations It is ineffective against B Proteus and Esch Coli organisms

III **STREPTOMYCIN****—though not inhibited by inactivating ferments of the coliform group is limited by its small spectrum of antibacterial activity Its chief action is against many gram negative rods, certain gram-positive cocci, and it exerts some degree of action against acid fast bacilli Streptomycin's chief disadvantage is that rapid resistance toward it develops by organisms which are not initially destroyed by higher concentrations of the agent The exact dose must depend upon bacterial sensitivity and the severity of the infection 1-2 Gms daily in divided dosage is given q 6 hrs around the clock In systemic infections Streptomycin is best given by intramuscular route Intrapleural, intrathecal, intraperitoneal and subcutaneous routes are employed in specific instances Inhalation of a Streptomycin aerosol may be used in certain pulmonary diseases Streptomycin given by nebulization alone or in combination with Penicillin is used in the preoperative preparation of patients with suppurative pulmonic lesions requiring lobectomy or pneumonectomy Intravenous administration of Streptomycin may on occasion produce severe allergic reactions

A TOXIC MANIFESTATIONS—limit the dosage and duration of Streptomycin therapy Some toxic side reactions and their management include

1 Allergic reactions
   a) Desensitization anti histaminic drugs, i e Benadryl, Pyribenzamine and Chlor-Trimeton, ACTH Cortisone and Hydrocortisone
2 Vertigo (Vestibular involvement)
   a) Reduction of dosage or discontinuance of drug

*Dubos in 1939 isolated from an extract of the soil bacillus B brevis from cultures of this strain Thyrothricin was isolated

**In 1944 Shatz Bugie and Waksman isolated a highly effective antibiotic from Streptomyces griseus. From 10 000 cultures Dr Selman A. Waksman relates Antibiotic substances were obtained from about 1 000 of them From 100 specimens—it was narrowed to 10 that seemed worth following closely Streptothricin was discovered in 1942 but it was too toxic for medical use it was not without value however for it (Streptothricin) led to the discovery of Streptomycin

tained with Dramamine 25 mgs orally

B DOSAGE

1 Local use Solutions of 500-1000 units/cc
Ointments of 500 u/Gm

2 **Adults** 10-20,000 units/I M q 8 hrs, may be stepped up to 25,000 units q 6 or 8 hrs if necessary Bacitracin may be given slowly via I V route, Dose 20-25,000 units in 500-1000 cc Physiological Saline Solution
Caution The total dose should not exceed 100,000 units

3 **Children** 200 units/kgm body weight q 6 hrs, may be increased to 400 units q 6 hrs

4 Intraperitoneal instillation of Bacitracin 1 or 2 oz. 2% solution, (1000 u/c c)
Note Best to employ a fine hypo needle in spraying

NOTES

IV BACITRACIN*

Bacitracin is derived from cultures of B Subtilis (Tracy), and exerts antibacterial action against gram positive organisms and certain gram negative cocci Bacitracin's activity is measured in units, 1 mg = 10 U)

Bacitracin is not inhibited by penicillinase No local or general toxicity is noted when Bacitracin is used locally It has a similar antibacterial spectrum to Penicillin but many other organisms are susceptible to Bacitracin that are not susceptible to Penicillin For optimum results an effective concentration of the antibiotic must be in contact with the organisms Bacitracin in solution or ointment from (500 u per cc) may be applied locally or injected directly into pyogenic lesions i e carbuncles and other suppurative lesions

Bacitracin is particularly valuable in the treatment of surgical infections because it is strongly bacteriocidal and it can be used both locally and systemically Patient s are seldom if ever allergic to it primarily, nor do patients become allergic to it after repeated or prolonged use Organisms only very slowly develop a resistance to Bacitracin and most of the Staphlococci now resistant to Penicillin, Streptomycin and the various Tetracyclines are susceptible to Bacitracin On many occasions it has been found that Bacitracin when injected into body cavities, i e joints, pericardium and pleural cavity can obviate the necessity of surgical interference **Meleney recommends systemic (intra muscular) administration of Bacitracin whenever the causative organisms is susceptible to it** Nephrotoxicity reported with earlier preparations of Bacitracin need not be feared According to Meleney, present day preparations of Bacitracin have reduced the incidence of this undesirable complication He cautions that a daily fluid intake of 2500 cc (for an adult) is important, and therefore recommends that a record of fluid intake and output be kept If the urinary output falls below 600 cc, Bacitracin should be stopped unless the life of the patient depends upon its continuance

A TOXICITY

1 A one plus (1+) albuminuria and cylinduria may be expected on the 3rd to 5th day of drug administration These findings usually decline after the 7th day and disappear with the termination of treatment
2 Check blood urea (BUN) once weekly if oliguria develops
3 Where nausea and vomiting develops relief may be ob-

*In 1945 Johnson Anker and Meleney discovered a new antibiotic from a strain of B Subtilis (gram positive sporulating bacillus) found in the course of a routine survey of bacterial flora found in contaminated wounds

VI CHLOROMYCETIN* (Chloramphenicol Parke-Davis) is a synthetic antibiotic that inhibits the growth of a wide spectrum of gram positive and gram-negative bacteria, rickettsias and viruses Chloromycetin is absorbed in therapeutic levels 30 min after oral or intramuscular injection Chloromycetin's mechanism of bacteriostasis is that of interfering with the synthesis of bacterial protein In contradistinction to the rapid and full resistance developed by E Coli to Streptomycin, only a gradual and short-lived resistance develops to Chloromycetin

Chloramphenicol is ineffective against yeasts, fungi and protozoa

A DOSAGE—Oral administration varies from 50, 100 and 250 mgs q 6 hrs around the clock A total dose of 10-15 gms is usually adequate for most acute infectious diseases An effective blood-level is usually 10 mgs per 100 cc of serum **Chloromycetin may also be administered intramuscularly or intravenously,** 100-200 mgs q 8 hrs around the clock It is recommended that 250 mgs of Chloromycetin be administered in 250 cc of I V fluid

B TOXICITY—Some of the more common but not serious side actions of Chloromycetin are nausea, gastritis, diarrhea, dryness and bitter sensations in the mouth Several cases of fatal aplastic anemia have been reported, some writers reported thrombocytopenic purpura, granulocytopenia and pancytopenia This evidence against Chloromycetin is not too conclusive especially so since the patients concerned in the various studies and reports were suffering from chronic infections over long periods of time and had received multiple medications Despite the infrequent number of complications reported we still recommend caution, but like administering any other strong but effective drug, one should always exercise the utmost caution yet be prepared to accept a certain amount of calculated risk **Chloromycetin has often been successful where Penicillin, Aureomycin, Streptomycin and Terramycin have failed**

Chloromycetin may be employed concurrently with Penicillin Streptomycin or Sulfonamide drugs without incompatibility, but no evidence exists at the present time of synergistic or even additive effects when combinations are employed

*In 1947 Burkholder discovered a new antibiotic from a soil organism Streptomyces Venezuela in a mulched field near Caracas Venezuela. Ehrlich et al in 1947 developed filtrates that yielded a crystalline antibiotic Chloromycetin was named Chloramphenicol of the pharmacopeia

V AUREOMYCIN* (Chlortetracycline), is beneficial in infections due to various gram-positive and gram-negative bacteria viruses, rickettsias, and protozoa It is especially useful against organisms which have become resistant to Penicillin, Streptomycin, and Sulfonamide drugs This antibiotic is effective by mouth and therapeutic levels may be attained in 6 or more hours When necessary Aureomycin may be given intravenously at a slow rate, intramuscular injections are too painful Aureomycin may be employed locally, either in powder, solution or ointment form

A DOSAGE—for adults 25 mgs per kgm body weight every 24 hrs divided into 4 equal doses, or 500 mgs q 6 hrs It is desirable to continue full dosage for 24-48 hrs after the temperature becomes normal If side reactions occur, the dosage may be reduced to one-half, but given twice as frequently Allergic reactions are not common

B TOXICITY—no fatal effects have been observed Frequent untoward signs and symptoms are **nausea, vomiting and diarrhea** A common complication is **pruritus ani** Administration of Aureomycin over a long term period may interfere with intestinal synthesis of vitamins Vitamin supplements should be administered prophylactically Another undesirable side action of prolonged Aureomycin administration is a profound change that takes place in the bacterial flora of the mouth, intestine and vagina **Abnormal infestation** of yeast-like organisms occurs, moniliasis of the lungs and perianal skin area) **Paraben and Mycostatin have been employed prophylactically with variable success in preventing the overgrowth of C Albicans and the occasional development of Staphylococcus Enteritis**

AUREOMYCIN is indicated in infections caused by the same organisms listed under Penicillin It is also indicated in the following infectious conditions

Rocky Mountain Spotted Fever
Rickettsial Pox
Rickettsial Typhus (Epedemic, Scrub and Murine)
Q Fever
Lymphogranuloma venereum
Psittacosis
Atypical pneumonias
Amebiasis

*In 1947 after studying thousands of microscopic fungi Dugger discovered an antibiotic from Streptomyces aureofaciens a soil organism

VII **TERRAMYCIN*** (Oxytetracycline-Pfizer)

Terramycin is inhibitory to certain gram negative enteric organisms, aerobic spore forming gram-positive cocci protozoa, viruses, and rickettsial diseases Terramycin is readily absorbed when taken orally or by parenteral route It diffuses through the placental barrier and into the pleural secretions cerebrospinal fluid bile and urine

TERRAMYCIN COMBINATIONS

As yet no synergism has been demonstrated between Terramycin and other antibiotics No synergism has been demonstrated between Terramycin and Erythromycin, though some additive effect have been observed

TERRAMYCIN—is indicated in acute infectious diseases caused by the following organisms

Pneumococci
Streptococci
Staphylococci
B Anthracis
B Abortus
A Aerogenes
Gonococci
T Pallidum
Lymphogranuloma venereum
Rickettsial Typhus (Scrub Epidemic and Murine)
E Typhosus
E Histolytica
E Coli
Shigella Paradysenteriae
B Subtilis

A DOSAGE
1 **ORAL**—25-50 mgs per kgm body weight, 0 25 Gm (250 mgs) q 6 hrs
2 **I V ROUTE**—1 Gm daily in I V fluids 0 5 Gm per liter of fluid

B TOXICITY —Terramycin is relatively non-toxic, in some patients Terramycin may produce nausea vomiting diarrhea and skin eruptions When taken orally Terramycin suppresses the growth of intestinal bacterial and encourages the growth of yeast-like micro-organisms When this occurs thrush or other forms of moniliasis may develop **Staphylococcal enteritis in which a severe diarrhea develops, is unfortunately being reported with increasing frequency**

*In 1950 Finlay and Associates isolated a crystalline antibiotic substance from a soil organism Streptomyces Rimosus

CHLOROMYCETIN—is indicated in infections caused by the following organisms

- Br Abortus*
- Br Melitensis*
- Br Suis*
- Esch Coli*
- K Pneumoniae (Friedlander s B)*
- H Ducreyi (B Ducrey)*
- H Influenzae Meningitis*
- H Pertussis*
- Gonoccocci
- Pneumococci
- R Prowazeki*
- R. Rickettsi*—(Dermacentroxenus Rickettsi)
- R Tsutsugamushi*
- Psittacosis*
- E Typhosus
- Shigella Paradysenteriae*
- Beta Hemolytic Streptococci
- Herpes Zoster*
- Atypical Pneumonias*
- Lymphogranuloma Venereum*
- T Pallidum

*Chloromycetin is considered the drug of first choice

NOTES

VII TERRAMYCIN* (Oxytetracycline Pfizer)

Terramycin is inhibitory to certain gram-negative enteric organisms, aerobic spore forming gram-positive cocci, protozoa, viruses, and rickettsial diseases Terramycin is readily absorbed when taken orally or by parenteral route It diffuses through the placental barrier and into the pleural secretions, cerebrospinal fluid, bile and urine

TERRAMYCIN COMBINATIONS

As yet no synergism has been demonstrated between Terramycin and other antibiotics No synergism has been demonstrated between Terramycin and Erythromycin, though some additive effect have been observed

TERRAMYCIN—is indicated in acute infectious diseases caused by the following organisms

Pneumococci
Streptococci
Staphylococci
B Anthracis
B Abortus
A Aerogenes
Gonococci
T Pallidum
Lymphogranuloma venereum
Rickettsial Typhus (Scrub Epidemic and Murine)
E Typhosus
E Histolytica
E Coli
Shigella Paradysenteriae
B Subtilis

A DOSAGE
1 ORAL—25 50 mgs per kgm body weight 0 25 Gm (250 mgs) q 6 hrs
2 I V ROUTE—1 Gm daily in I V fluids 0 5 Gm per liter of fluid

B TOXICITY—Terramycin is relatively non toxic, in some patients Terramycin may produce nausea, vomiting diarrhea and skin eruptions When taken orally, Terramycin suppresses the growth of intestinal bacterial and encourages the growth of yeast-like micro organisms When this occurs, thrush or other forms of moniliasis may develop **Staphylococcal enteritis in which a severe diarrhea develops, is unfortunately being reported with increasing frequency**

*In 1950 Finlay and Associates isolated a crystalline antibiotic substance from a soil organism Streptomyces Rimosus

CHLOROMYCETIN—is indicated in infections caused by the following organisms

Br Abortus*
Br Melitensis*
Br Suis*
Esch Coli*
K Pneumoniae (Friedlander s B)*
H Ducreyi (B Ducrey)*
H Influenzae Meningitis*
H Pertussis*
Gonoccocci
Pneumococci
R Prowazeki*
R Rickettsi*—(Dermacentroxenus Rickettsi)
R Tsutsugamushi*
Psittacosis*
E Typhosus
Shigella Paradysenteriae*
Beta Hemolytic Streptococci
Herpes Zoster*
Atypical Pneumonias*
Lymphogranuloma Venereum*
T Pallidum

*Chloromycetin is considered the drug of first choice

NOTES

X POLYMYXIN—is a generic term given to a number of antibiotics derived from the bacillus polymyxa These various antibiotics are designated Polymyxin A, B, C, D and E As a group the Polymyxins differ from one another in their amino acid content Polymyxin-B is especially effective in infections caused by Pseudomona Aeruginosa, (B Pyocyaneus) This organism is still resistant to most therapeutic and antibiotic agents

POLYMYXIN B (Aerosporin or Polymyxin-Sulphate), has a *bacteriocidal* effect on B Pyocyaneus *in vitro* Polymyxin-B has been employed with varying degrees of success in serious infections caused by gram-negative organisms that have failed to respond to any other treatment Polymyxin B is not absorbed from the intestinal tract or from the cerebro spinal fluid, it is used locally or administered systemically via the intramuscular or intrathecal route

POLYMYXIN-B Sulphate, (Aerosporin) has been effectively employed in the following instances

1 Pseudomonas aeruginosa infections
2 Shigella infections
3 Influenza (Hemophilus Influenzae)
4 Coliform infections (Esch Coli)
5 Infections caused by Aerobacter Aerogenes
6 Infections caused by Klebsiella Pneumoniae

A DOSAGE INTRAMUSCULARLY, Polymyxin-B enters the blood stream rapidly Dose 2 5 mg per kgm body wt The total dose should not exceed 250 mgs daily

B TOXICITY ORALLY, Polymyxin-B 50 mg Tab 1 q 6 hrs around the clock Polymyxin-B should be used with caution especially where renal damage and nitrogen retention are known to exist, A further increase in nitrogenous retention may develop Nephrotoxic effects caused by Polymyxin B is characterized albuminuria, cellular casts and *azotemia* Neurotoxic effects have also been observed, but most observers agree that these effects are transient and disappear soon after the discontinuance of the drug

VIII MYCOSTATIN—(Nystatin) is an effective agent against intestinal fungi It eliminates Candida (Mordia) from the stool within a few days Mycostatin is employed prophylactically in patients who are being prepared for intestinal surgery with oral antibiotics Where prolonged treatment with oral antibiotics is necessary, Mycostatin may provide valuable protection against the development of Monilial Enteritis

A DOSAGE 1 tablet (500 000 units) q i d

IX TETRACYCLINE—This new antibiotic is closely related chemically to Aureomycin and its antibacterial spectrum is approximately the same Tetracycline is known as Achromycin (Lederle) and as Tetracyn (J B Roerig) The advantages of Tetracycline according to drug manufacturers are greater stability, better absorption and more effective penetration Tetracycline supposedly results in more prolonged blood levels and higher concentrations in the cerebro spinal fluid We doubt that such marked differences exist

NOTES

XIII **CARBOMYCIN***—(MAGNAMYCIN) is derived from Streptomyces halstedii Carbomycin is most effective against gram-positive organisms To a lesser degree it is effective against some large viruses, rickettsiae and pathogenic protozoa It is mainly employed against Staphylococcic organisms that have become resistant to other antibiotics, or in patients who have become hypersensitive to Penicillin

A DOSAGE

Orally 1 to 2 Gms daily

Intravenously 400 mg q 6-8 hrs

B TOXICITY Not great, transient skin eruptions and intestinal upsets have been reported

XIV **NEOMYCIN****—Is bacteriocidal in vitro against a wide variety of gram negative positive organisms NEOMYCIN IS POORLY ABSORBED FROM THE INTESTINAL TRACT AND FOR THAT REASON IS EFFECTIVELY EMPLOYED PREOPERATIVELY FOR BOWEL STERILIZATION When Neomycin is combined with Bacitracin, Streptomycin, Sulfasuxadine Sulfathaladine and Aureomycin, its bowel sterilizing ability becomes enhanced

Neomycin is effective locally when instilled into peritoneal cavity

Dose

Infant 200 mg in 1 oz saline

Adult 500 mg in 1 oz saline

A TOXICITY Clinical usefulness is limited because of its high incidence of renal and 8th nerve damage Neomycin should not be given parenterally unless all other antibiotics have failed, and the life of the patient is in jeopardy A minimum urinary output of 1,000 cc should be maintained

*References 1 Bartz Q J Biol. Chem 172 445 1948
2 Finlay A C et al Science 106 417 1947

**Neomycin was discovered by Drs Waksman and Lechevalier in 1949 It was cultured from a strain related to Streptomyces fradiae Neomycin appears effective against Streptomycin sensitive and Streptomycin resistant strains of tubercle bacilli especially in extrapulmonary lesions

XI **VIOMYCIN***—is an antibiotic isolated from Streptomyces floridae It appears to be active against the Tubercle Bacillus in vivo and in vitro Thus far this antibiotic has been used exclusively in Tuberculosis Viomycin is ineffective orally and is contraindicated by intravenous route, IT IS ADMINISTERED ONLY BY INTRAMUSCULAR ROUTE

A DOSAGE Not to exceed 2 Gms every 3 days

B TOXICITY This antibiotic may induce 8th nerve damage Allergic reactions and impaired renal function have been reported

XII **ERYTHROMYCIN**—Trade names are Ilotycin and Erythrocin Erythromycin is effective against many gram positive and certain gram negative bacteria Erythromycin is especially effective against certain Staphylococci and Streptococcus faecalis, it is ineffective against most coliform bacilli This antibiotic exerts its greatest effect against an active infection, i e multiplying bacteria

Erythromycin may be used against gram positive bacteria resistant to other antibiotics and it is especially valuable because it does not predispose to monilial infections with attendant puritis ani and vaginal irritation

A DOSAGE ORALLY

Adults—200-500 mg q 6 hrs

Children—6-8 mg /kgm body wt q 6 hrs

*In 1950 Bartz et al isolated a new antibiotic from cultures of Streptomyces floridae Findlay and his associates working independently described the same antibiotic

NOTES

XIII CARBOMYCIN*—(MAGNAMYCIN) is derived from Streptomyces halstedii Carbomycin is most effective against gram-positive organisms To a lesser degree it is effective against some large viruses, rickettsiae and pathogenic protozoa It is mainly employed against Staphylococcic organisms that have become resistant to other antibiotics, or in patients who have become hypersensitive to Penicillin

A DOSAGE

Orally 1 to 2 Gms daily

Intravenously 400 mg q 6-8 hrs

B TOXICITY Not great, transient skin eruptions and intestinal upsets have been reported

XIV NEOMYCIN**—Is bacteriocidal in vitro against a wide variety of gram-negative positive organisms NEOMYCIN IS POORLY ABSORBED FROM THE INTESTINAL TRACT AND FOR THAT REASON IS EFFECTIVELY EMPLOYED PREOPERATIVELY FOR BOWEL STERILIZATION When Neomycin is combined with Bacitracin, Streptomycin, Sulfasuxadine, Sulfathaladine and Aureomycin, its bowel sterilizing ability becomes enhanced

Neomycin is effective locally when instilled into peritoneal cavity

Dose

Infant 200 mg in 1 oz saline

Adult 500 mg in 1 oz saline

A TOXICITY Clinical usefulness is limited because of its high incidence of renal and 8th nerve damage Neomycin should not be given parenterally unless all other antibiotics have failed, and the life of the patient is in jeopardy A minimum urinary output of 1 000 cc should be maintained

*References 1 Bartz Q J Biol. Chem 172 445 1948

2 Finlay A C et al Science 106 417 1947

**Neomycin was discovered by Drs Waksman and Lechevalier in 1949 It was cultured from a strain related to Streptomyces fradiae Neomycin appears effective against Streptomycin-sensitive and Streptomycin resistant strains of tubercle bacilli especially in extrapulmonary lesions

XI **VIOMYCIN***—is an antibiotic isolated from Streptomyces floridae It appears to be active against the Tubercle Bacillus in vivo and in vitro Thus far this antibiotic has been used exclusively in Tuberculosis Viomycin is ineffective orally and is contraindicated by intravenous route, IT IS ADMINISTERED ONLY BY INTRAMUSCULAR ROUTE

A DOSAGE Not to exceed 2 Gms every 3 days

B TOXICITY This antibiotic may induce 8th nerve damage Allergic reactions and impaired renal function have been reported

XII **ERYTHROMYCIN**—Trade names are Ilotycin and Erythrocin Erythromycin is effective against many gram positive and certain gram negative bacteria Erythromycin is especially effective against certain Staphylococci and Streptococcus faecalis, it is ineffective against most coliform bacilli This antibiotic exerts its greatest effect against an active infection, i e multiplying bacteria

Erythromycin may be used against gram-positive bacteria resistant to other antibiotics and it is especially valuable because it does not predispose to monilial infections with attendant puritis ani and vaginal irritation

A DOSAGE ORALLY

Adults—200-500 mg q 6 hrs

Children—6-8 mg /kgm body wt q 6 hrs

*In 1950 Bartz et al isolated a new antibiotic from cultures of Streptomyces floridae Findlay and his associates working independently described the same antibiotic

NOTES

XVI AMPHOTERICIN B —(Fungizone Squibb)

A new antifungal antibiotic derived from a species of Streptomyces Amphotericin B is prepared as a lyophilized yellow powder and used parenterally in a 5% Dextrose solution PHYSIOLOGICAL SALINE SOLUTION SHOULD NOT BE USED IT PRECIPITATES THE ANTIBIOTIC!

A INDICATIONS Amphotericin B is indicated in patients afflicted with the following disseminated mycotic infections

1 Torulosis
2 Coccidioidomycosis
3 Histoplasmosis
4 Blastomycosis (North American)
5 Disseminated Moniliasis

B DOSAGE AND ADMINISTRATION—**Intravenous Route**

0 25 mg of Amphotericin B per kgm body wt /daily The dosage may be increased gradually from 0 5 to 1 0 mg per kgm body wt /daily **Within the range of 0 25 mg to 1 mg, the largest possible dose failing to elicit toxic reactions may be carefully administered**

Amphotericin B is poorly excreted by the kidneys a rise in N P N and blood urea should be carefully avoided It should be noted that an increase in dosage above 1 mg /kgm body/wt will not necessarily hasten a slow clinical response of a deep-rooted mycotic infection When clinical improvement is manifested the daily dosage may be extended to alternate days

When the administration of Amphotericin B is reinstated after a week or more of discontinuance the minimum daily dosage of 0 25 mg kgm /body wt is recommended with gradual increase to optimum levels To restart Amphotericin B with initial dosage may induce chills and fever

Length of therapy varies with the severity of the infection Clinical improvement has followed 4 to 8 weeks of continuous therapy In cases with extended Amphotericin B treatment liver, kidney marrow and blood studies at regular intervals are recommended

XV **OLEANDOMYCIN**—(PA-105, matromycin, Romicil in U S A)
SPIRAMYCIN (Rovamycin), in France

Oleandomycin and Spiramycin are both active in vitro over the same range of bacterial spectrum as is Erythromycin, but they are less active against most species and strains

These new 'mycins" including Erythromycin and Carbomycin show cross resistance In extensive studies* made on antibiotic combinations the following observations were made

> 'For most strains, the pairs of antibiotics are more often inferior to the better of the individual components Mixtures of Tetracycline with either Oleandomycin and Spiramycin are decidely inferior to the more active one of the two antibiotics

*Finland and Jones N England J Med Vol 257 No 11 Sept 12 1957

NOTES

D TOXICITY The authors recommend that Rystocetin be used with caution Until more experimental and clinical data are compiled, **Rystocetin should be employed only in cases of resistant staphylococcal infections**

XVIII **KANAMYCIN SULPHATE (KANTREX)***

A new water-soluble antibiotic derived from Streptomyces kanamyceticus Kanamycin—in vitro and vivo studies—has demonstrated its activity against a wide spectrum of Gram-positive and Gram-negative organisms It has also demonstrated activity against infections caused by recalcitrant organisms, (i e)

1 Micrococcus pyogenes var aureus
2 Mycobacterium tuberculosis

Kanamycin has proven itself effective against 'stubborn strains' responsible for 'hospital infections' and against organism resistant to other antibiotics

Kanamycin is bacteriostatic and bactericidal Its bacterial efficacy against many strains resistant to other antibiotics is its most impressive characteristic

A INDICATIONS
 1 SYSTEMIC
  a) Infections due to organisms shown sensitive to Kanamycin
  b) Infections due to stubborn-organisms resistant to other antibiotics
  c) Infections of the
   1) Respiratory tract
   2) Genito urinary tract
  d) Infections of
   1) Pre- and Postoperative period
   2) Bone (osteomyelitis and periostitis)
   3) Blood (septicemia and bacteremia)
 2 LOCAL
  a) Preoperative bowel sterilization
  b) Infections of gastro intestinal tract (combined systemic and local administration may be necessary)

B TOXICITY

Utilizing recommended dosage no severe toxic reactions for cardiovascular and hemopoietic systems, liver or skin have been reported Mild dermatitis, lowered blood count and liver function tests have been reported

C DOSAGE
 1 INTRAMUSCULAR (Systemic treatment)
  a) **Adults**—daily dose 1-2 Gms , (give in 2-4 divided doses)

*Kantrex (Kanamycin)—Bristol Myers Inc Syracuse N Y

XVII **RISTOCETIN**—(Spontin-Abbott)

A new antibiotic developed in the Abbott Laboratories Ristocetin has been isolated in crystalline state from the fermentation of beer of a new species of actinomycetes, (Nocardia Lurida) It has two components, A and B, both of which are particularly active against gram positive bacteria Components A and B are stable in aqueous solutions, less stable at a pH 7, and easily inactivated in alkali Rystocetin is a lyophilized preparation representing components A and B

The antibiotic properties of Rystocetin are unique Unlike Penicillin *which becomes bactericidal with increasing dosage* Rystocetin possesses both bacteriostatic and bactericidal properties in the same concentrations

A INDICATIONS Rystocetin (Spontin), is indicated in the treatment of gram positive bacterial infections, although limited effectiveness has also been demonstrated clinically in streptococcal and pneumococcal infections **Rystocetin is indicated in those cases of staphylococcal infections that have proven resistant to all other antibiotics** Rystocetin does not penetrate through the meninges but it may reach infections of the nervous system where the organisms are accessible to the antibiotic in the circulating blood

B METHOD OF ADMINISTRATION

1 Rystocetin is administered only via intravenous route[1]
2 The required dosage of Rvstocetin is dissolved in 5% Dextrose in water and administered over 30 to 45 minutes
3 250 mg Rystocetin is dissolved in 125 cc solution, 500 mg Rystocetin is dissolved in 250 cc solution, 1,000 mg (1 Gm) may be administered in 1 liter of solution
4 Maximum concentration for I V use is 1 25%
5 Maximum rate of administration is (30 drops) 2 cc per minute

C DOSAGE

1 For staphylococcal infections give 25-50 mg /kgm body weight per dav 6 Gms /daily should be the maximum daily dose
2 For streptococcal and pneumococcal infections give 25 mg /kgm body weight per day
3 The estimated daily dose should be divided into 2 or 3 equal parts and administered on a q 12 or 8 hr schedule
4 Dosage and duration of treatment should depend upon the clinical course of the disease

d) Pneumococcus

B TOXICITY

VANCOMYCIN SHOULD BE AVOIDED IN PATIENTS WITH POOR RENAL FUNCTION UNDESIRABLE REACTIONS CAUSED BY VANCOMYCIN ARE

a) WARMTH, NAUSEA AND GENERALIZED TINGLING
   1) Caused by too rapid I V administration
b) THROMBOPHLEBITIS
   1) Caused by prolonged I V administration
c) PAIN
   1) Caused by extravasation of drug
d) CHILLS, FEVER AND URTICARIA
   1) Relieved by antihistaminic drugs
e) TINNITUS, DECREASED HEARING AND DEAFNESS
   1) Caused by excessive serum levels, (i e) over 100 ml /100 cc

C DOSAGE

1 ADULTS
   a) INTERMITTENT I V
      1) 500 mg Vancomycin in 250 ml Physiological Saline Solution, or 5% Dextrose in water
      2) Allow 30 min to run in repeat q 6 or 8 hrs
   b) CONTINUOUS I V
      1) 1 or 2 Gms in 3 liters Physiological Saline Solution, or 5% Dextrose in water
      2) Allow 24 hours to run in
2 CHILDREN
   a) 20 mg per pound/body weight for 24 hrs
   b) Add calculated dose to Physiological Saline Solution or 5% Dextrose in water
      1) May be administered intermittantly or by continuous I V

b) **Children**—daily dose 15-30 mg per kgm body weight, (give in 2 4 divided doses)

2 ORAL—(Local treatment) **Kanamycin sulphate is not absorbed from G-I tract)**

a) Preoperative bowel sterilization
2 caps (1 Gm) every 1 hr q 4 hrs, then step up to—
2 caps q 3 hrs for 3 days

b) Gastro-intestinal infections
2 caps (1 Gm) or 4 caps (2 Gm) q 4 or 6 hrs for minimum of 5 days

XIX VANCOMYCIN (VANCOCIN)*

A new antibiotic obtained from strains of streptomyces orientalis —and prepared as the hydrochloride Preliminary studies indicate that Vancomycin is effective against STAPHYLOCOCCI that have shown resistance to other antibiotics There is evidence to show that Vancomycin does not exhibit cross-resistance with other antibiotics

Bactericidal concentrations of Vancomycin in the blood is rapidly attained and maintained by intravenous administration Significant concentrations of the antibiotic have been observed in the pleural, pericardial ascitic and synovial fluids as well as in the urine Vancomycin apparently does not readily diffuse into the normal spinal fluid—but may do so when the meninges are inflamed

Vancomycin is not incompatible with other antibiotics and may therefore be added to I V solutions containing

a) Ilotycin (Erythromycin)
b) Penicillin
c) Tetracycline (Tetracyn and Terramycin)
d) Chloramphenicol (Chloromycetin)

A INDICATIONS

1 **Vancomycin** should not be recommended for routine use —at the present time
2 **Vancomycin** should preferably be employed in staphylococcal infections that have failed to respond to other antibiotics
3 **Vancomycin** should be employed in hospitals where resistant staphylococcal infections have appeared in increasing number **
4 **Vancomycin** is indicated in infections caused by the following recalcitrant organisms
a) Staphylococcus
b) Enterococcus
c) Streptococcus

*Discovered and developed by Lilly Research Laboratory
**Some hospitals restrict the routine use of Vancomycin and release it only when specific indications appear The Hospital Infection Committee must give the final O K

ORDERS FOR ACUTE SURGICAL ABDOMEN

(LAPAROTOMY)

I PREOPERATIVE PROCEDURE

A WORKUP

1. Complete blood count, (stat), W B C and differential repeated every two hours in questionable cases
2. Complete urinalysis, (stat)
   a) Clean specimens in all female patients
   b) Catheterize if patient cannot void, or if specimen contains pus cells or blood
3. Wassermann or Kahn
4. Routine flat film of abdomen, (standing and lying down), search for gas patterns, shifting bubbles of free air, calcifications masses, fluid levels, organ distention, displacement, etc
5. Stool specimen for blood or parasites
   a) Rectal examining finger tested for gross or chemical blood
6. Cervical smear rule out Gonococci, (Gram-negative intra- and extra-cellular diplococci)
7. Sedimentation Rate
8. Rectal temperatures only
9. Type and cross match blood and order 2 units of whole blood in bank, have donors standing by

B MEDICATION

1. No narcotic drugs are employed until a diagnosis has been established
2. Antibiotics given only after diagnosis is established
3. Demerol—50 to 100 mg } 1 hr before surgery
   Scopolamine gr 1/150 }

C MANAGEMENT

1. Nothing by mouth!
2. I V Fluids may be given while diagnosis is being established
3. No Enemas!
4. PREP—Abdomino perineal—from nipples to mid thighs
5. If stomach is likely to contain food—aspirate to prevent aspiration during surgery and in the postoperative period THIS PROCEDURE IS ROUTINE IN CHILDREN
6. On call to Surgery as soon as possible

II POSTOPERATIVE PROCEDURE

A MANAGEMENT

1. Check blood pressure, pulse and respiration every 15 minutes until stabilized then q thirty minutes 4 times, q 1 hour 4 times then every 3 hours for 24 hours
2. Encourage Early Ambulation' (Dont 'freeze patient in

BACTERIAL SENSITIVITY TESTS

Before efficient use can be made of an antibiotic, the sensitivity of the the infecting organism should be known For routine determinations of bacterial susceptibility—2 methods are available

1 Paper disk or tablet method
2 Test tube dilution technic

I **PAPER DISK METHOD**—requires filter paper disks or tablets impregnated with antibiotic solution of desired concentration and a suitable culture medium The blood agar plate is most satisfactory

1st—Innoculate agar plate with suspension of infectious material

2nd—Place 6 or 8 disks on the plate surface, this allows several antibiotics or several concentrations to be evaluated at once

3rd—Antibiotic sensitivity is evaluated after overnight incubation This is a qualitative rather than a quantitative test The results may be reported ' slightly susceptible or highly susceptible" depending on whether there is a small ring or a large ring of inhibition around the disc

NOTE Results may be available from 6-18 hours It must be remembered that the disk method indicates either sensitivity' or 'non-sensitivity', no more!

II **TEST TUBE DILUTION METHOD**—is considered a more accurate technic Since this method requires isolation of a pure bacterial culture, preparation of a standard inoculum and inoculation of a serially diluted antibiotic, more time and expense are involved The dilution technic is especially employed in such instances as

1 Subacute Bacterial Endocarditis
2 Where it is necessary to detect increased bacterial resistance in patients who relapse during antibiotic therapy

NOTES

ORDERS FOR GALLBLADDER CASES
(WITHOUT JAUNDICE)

A careful HISTORY AND PHYSICAL EXAMINATION are necessary in these cases because of the frequent association of simulating intra- and extra abdominal pathology, such as peptic ulcer, diaphragmatic hernia, appendicitis, coronary and pulmonary diseases Considerably more emphasis should be placed upon the gallbladder X-Ray studies (Graham Cole Test and Cholografin Studies) It must be remembered that at autopsy 10-15% of patients past 45 years of age reveal 'silent' or ' asymptomatic" stones in the gallbladder

DO NOT neglect rectal and vaginal digital examinations Fibroids of the uterus not infrequently co-exist with chronic gallbladder disease Men over forty five years of age should be examined carefully for any co-existing pulmonary or cardiac disease An EKG is necessary whereever any suggestion of chest pain or epigastric distress exists In elderly patients with anemia attempt to rule out associated malignancies Aged and debilitated patients, especially those with complications (i e) jaundice, cardiac disease, renal disease and diabetes mellitus will require more careful and prolonged pre- and postoperative care (See chapters on Surgical Patients with Cardiac Renal and Diabetic Diseases)

I **PREOPERATIVE PROCEDURE**

A **WORKUP**

1 Complete blood count

2 Complete Urinalysis
- a) Urobilinogen
- b) Bile (urinary)

3 Wassermann or Kahn

4 Blood Chemistry (FASTING STOMACH)
- a) A/G Ratio
- b) Liver Function Tests
  - 1) Cephalin-Flocculation
  - 2) Thymol Turbidity
  - 3) Prothrombin Time
  - 4) Alkaline Phosphatase
  - 5) Bromsulphalein
  - 6) Gamma Globulin
  - 7) Galactose Tolerance Test
  - 8) Total Cholesterol and Cholesterol Esters
- c) Renal Studies
  - 1) N P N , Urea and Creatinine as required

5 X Ray Studies
- a) Graham-Cole Visualization Test (Single or Double Dye dose), Cholografin studies
- b) Flat Film of Abdomen (routine)

bed with pillows sheets, or by breaking foot of bed)

a) Deep breathing q 15 minutes

b) Leg exercises, kicking and side to side turning

c) Select cases may get up for bathroom privileges on the 1st P O, (on order of Surgeon)

3. Catheterize every 8-10 hours, (P R N) for distress discomfort, or distention (Employ strict asepsis)

4. Levin-Wangensteen Suction (16-18F rubber tube), Routine when ileus or peritonitis exist

5. Rectal tube—q i d for ½ hour, and P R N

6. **I V Fluids**—as needed, (See "Parenteral Fluids), usually 3 liters daily, (on order of Surgeon)

Example

1st liter—5% Dextrose in water, plus 500 mg Terramycin (or order of Surgeon)

2nd liter—5% Dextrose in water, add
Vitamin B, (1 amp solu B)
Vitamin C, (500 mg)
Vitamin K, (10-50 mg, (on order of Surgeon)

3rd liter—5% Dextrose in Physiological Saline Solution Add 3 Gms KCl, (40 mEq/L) when Levin-Wangensteen suction is continued over 24 hours

B **MEDICATION**

1. **Demerol**—50 to 100 mg for pain or restlessness (Give only when patient is fully awake)

2. Antibiotics—(on order of Surgeon)

a) Penicillin, Streptomycin Combiotic, Bacitracin, Polymyxin-B Terramycin, Chloromycetin and Achromycin may be employed to combat existing or anticipated infections and complications (See "ANTIBIOTICS)

3. **Thorazine**—25 mg **Dramamine**—25 mg, **Compazine**—5 mg

a) For postnausea or vomiting q 4 hrs, P R N

4. Phenobarbital—gr 1 (hypo) q P M h s

4 **Levin-Wangensteen Suction**—for intestinal decompression
   a) Check tube patency q ½ hr
   b) Check suction machine—check plug, tubing, current, connections, etc
   c) May allow sips of water—while suction is on, (helps clean tube) Record Aspirate, (amount character, etc)
   d) May use 50 cc syringe to clear Levin tube
   e) ONLY THE DOCTOR ADJUSTS THE LEVIN TUBE

5 Catheterize q 8-10 hrs for distention or distress, P R N (Sterile precautions must be observed)

6 Rectal tube—q 4 hrs for ½ hr , and P R N

7 Record daily Fluid Intake and Output, chart

8 Oxygen (Intranasally) on order of Surgeon or Anesthetist

9 Transfusions are given when indicated, (i e) 'surgical shock , anemia hypovolemia, etc

10 Return-flow enema, (Harris Flush)—on 3rd or 4th post-operative day, 2 qt S S Enema after 6th day, P R N , (On order of surgeon)

11 **DIET**—If patient progresses satisfactorily—Surgical' and Nourishing' liquids are started on the 2nd or 3rd postoperative day Gradually increase to 'Soft Diet' and Bland Diet as tolerated. 'General Diet' after the 4th P O Day and 'Special Diet' as required, or on order of surgeon

NOTES

c) X-Ray of Colon to rule out associated diseases of the colon

d) I V Pyelogram in select cases

6 Type and Cross Match, order 2 pints of blood in bank, (or obtain 2 compatible donors)

B MEDICATION

1 Correct any existing deficiency revealed in **WORKUP**
2 Phenobarbital gr ½ t i d (orally)
3 Phenobarbital gr I or gr II (hypo) at 9 00 p m, Give 1 hr before Levin tube is to be inserted
4 Check with patient for any sensitivity to antibiotics **If not** sensitive—give Combiotic—1 ampoule (full strength) I M, night before surgery (On order of surgeon)
5 Demerol—75-100 mg } 1 hr before surgery
Scopolamine—gr 1/150 }
Phenergan—25 mg (at discretion of Anesthetist)

C *MANAGEMENT*

1 DIET—Hi-carbohydrate, Hi protein, Hi-vitamin Hi mineral, and low or no fat (Adjust to patient's individual caloric requirements)
2 Bathroom privileges as indicated
3 PREP Abdomino-perineal, (from nipples to mid-thighs)
4 Insert Levin tube (16-18 F) at 10 00 p m, attach to Wangensteen suction throughout the night Levin tube should be avoided whenever the patient is too nervous or upset In such instances insert Levin tube in the immediate preoperative period (1 or 2 hrs before surgery)
5 2 qt S S Enema—night before surgery
6 Nothing by mouth after 6 P M, except water on evening before surgery, no water after midnight

II IN OPERATING ROOM

A I V fluids blood or plasma—as ordered by surgeon

III POSTOPERATIVE PROCEDURE

A MANAGEMENT

1 **Check Blood Pressure and Pulse q 15 minutes until stabilized**, then q 30 minutes 4 times then q 1 hr 4 times thereafter q 3 hrs for 24 hrs
2 Early Ambulation—encourage deep breathing coughing leg exercises and side to-side turning of patient
   a) AVOID any compression of calf muscles by pillows angulation of bed at knee level, tightly drawn sheets over toes pillows under arms and at side of patient
   DO NOT 'FREEZE' PATIENT IN BED'
3 Elevate backrest slowly to relax abdominal incision after patient awakens

4 Levin Wangensteen Suction—for intestinal decompression
   a) Check tube patency q ½ hr
   b) Check suction machine—check plug, tubing, current, connections, etc
   c) May allow sips of water—while suction is on, (helps clean tube) Record Aspirate, (amount character, etc)
   d) May use 50 cc syringe to clear Levin tube
   e) ONLY THE DOCTOR ADJUSTS THE LEVIN TUBE
5 Catheterize q 8-10 hrs for distention or distress, P R N (Sterile precautions must be observed)
6 Rectal tube—q 4 hrs for ½ hr, and P R N
7 Record daily Fluid Intake and Output, chart
8 Oxygen (Intranasally) on order of Surgeon or Anesthetist
9 Transfusions are given when indicated, (i e) surgical shock, anemia, hypovolemia etc
10 Return flow enema, (Harris Flush)—on 3rd or 4th post-operative day, 2 qt S S Enema after 6th day, P R N (On order of surgeon)
11 DIET—If patient progresses satisfactorily—Surgical and Nourishing' liquids are started on the 2nd or 3rd postoperative day Gradually increase to 'Soft Diet' and Bland Diet as tolerated. 'General Diet' after the 4th P O Day and Special Diet' as required, or on order of surgeon

NOTES

12 **I V FLUIDS**

a) 3 liters every 24 hours, in addition replace the amount of fluid aspirated by Levin-Wangensteen suction,

1st liter—5% Dextrose in distilled water, (add 500 mgs Terramycin when indicated)

2nd liter—5% Dextrose in distilled water, (add Vitamins, B-complex and C, Vitamin K when indicated)

3rd liter—5% Dextrose in Physiological Saline Solution, (add 3 Gms KCl when indicated)

13 Penrose drain—loosened on 3rd day and removed after 5 to 7 days—on order of surgeon

B **MEDICATION**

1 Demerol—75-100 mg for pain q 4 hrs P R N If ineffective switch to Dilaudid—gr 1/64 or gr 1/32
2 Combiotic—1 ampoule (full strength) I M daily (On order of surgeon)
3 Thorazine, Dramamine, or Bonamine—15-25 mg q 4 hrs P R N for post nausea or post-vomiting On order of surgeon
4 Phenobarbital—gr 1 or grs 11 q bedtime

C **FOLLOW-UP LAB**

1 Order any lab work needed in postoperative period

NOTES

ORDERS FOR GALLBLADDER CASES
(WITH JAUNDICE)

Jaundice in gallbladder disease indicates the presence of complicating factors such as liver damage and marked tendency toward hemorrhage, especially during and after operative procedures Surgery performed on patients with obstructive jaundice is always serious and should never be undertaken without careful and intensive preoperative preparation Even though the jaundice grows deeper, several days of preparation should be devoted to further improve the patient prior to surgery Sitophobia invariably leads to a general nutritional deficiency—which when recognized must be corrected before surgery A diet high in carbohydrate, protein and vitamins is routinely prescribed—but when debilitated patients are encountered, longer periods of preparation are necessary Intravenous sugar solutions are of supplemental value for storing liver glycogen Anemia when discovered must be corrected Parenteral Vitamin K usually improves a prolonged prothrombin time Blood sugar, lipase, transaminase and amylase studies may reveal associated pancreatic disease

It is seldom necessary to operate immediately upon a patient with increasing jaundice Even Charcot s Intermittent Fever due to ball valve action of a stone in the common duct should preferably be treated with conservatism at first If at all possible we avoid surgery on the biliary tract while the jaundice is becoming more intense but prefer to operate as soon as the jaundice stabilizes or begins to diminish

I PREOPERATIVE PROCEDURE

A WORKUP

1 Complete blood count
2 Complete Urinalysis
   a) Urobilinogen
   b) Bile
3 Wassermann or Kahn
4 Prothrombin Time—daily until almost normal is attained
5 Type and Cross Match order 2 or more pints of blood in bank (or obtain 2 compatible donors)
6 Icteric Index
7 Serum Bilirubin
8 Van den Bergh Test
9 **Blood Chemistry** (Fasting Stomach)
   a) A/G Ratio (A and G gives total protein)
   b) LIVER FUNCTION TESTS
      1) Cephalin Flocculation Test
      2) Thymol Turbidity
      3) Alkaline Phosphatase
      4) Bromsulphalein
      5) Gamma Globulin

6) Total Cholesterol
7) Cholesterol Esters

c) N P N and Blood Urea when
1) Icteric index is over 100
2) Evidence of renal disease co exists
3) Jaundice has been unduly prolonged

d) Serum Iron (Elevated in Infectious Hepatitis, Normal or slightly elevated in obstructive jaundice)

10 **X Ray Studies**

a) No dye studies are attempted in the presenc of jaundice, (Cholecystogram or Cholografin studies)
b) Flat film of abdomen (routine) Search for calculi

11 Stool to laboratory

a) Color
b) Bile and Urobilinogen
c) Occult Blood

B **MANAGEMENT**

1 SAME AS—"MANAGEMENT UNDER "GALLBLADDER WITHOUT JAUNDICE"
2 Blood Transfusions—*as required, especially where jaundice* is severe or has been unduly prolonged
3 Order drainage bottle and I V plastic tubing for T-tube drainage at bedside also Levin Wangensteen suction apparatus

C **MEDICATION**

1 Correct any existing deficiencies revealed in **WORKUP**
2 Vitamin K Preparations, (i e) Synkavite, Vitamin K_1 (Merck) Synkamin or any other approved Vitamin K synthetic preparation Give I V , I M or both ways We prefer Vitamin K_1, (Mephyton Merck)
3 Bile salts—i e Bilron Decholin Metachol, Cholan HMB—with oral Vitamin K
4 Vitamin D (Viosterol) orally
   a) In jaundice there is usually a faulty fat absorption and an associated poor fat soluble-vitamin' absorption Therefore Vitamins A D E and K are given prophylactically
5 Calcium Gluconate orally
6 Check with patient for any antibiotic sensitivity *if not sensitive* give Combiotic—1 ampoule (full strength) I M , evening before surgery (on Surgeon s order)
7 Night medication—(preferably ordered by Anesthesiologist) Phenobarbital grs 11 (hypo)
8 *Scopolamine*—gr 1/150 } 1 hr before surgery
   Demerol—75 100 mg }

Phenergan—25 mgs —(added at discretion of Anesthetist)

II IN OPERATING ROOM

A 5% Dextrose in water I V, (Routine), use 18 gauge I V needle

B Physiological Saline Solution if patient is to receive a Blood Transfusion

C Vitamin K_1—I V use during surgery, (on Surgeon's order)

III POSTOPERATIVE ORDERS

Same routine postoperative orders as listed under "Gallbladder Cases Without Jaundice , Additional considerations are listed below

A **These orders apply to 4 Groups**

1 Cholecystectomy and Cholecystostomy
2 Choledochostomy—with or without drainage
3 Cholecysto—or choledocho-jejunostomy
4 Any reconstruction of continuity of biliary tract

B **Inspect and Record the Following Data Daily**

1 Prothrombin Time—on 3rd, 6th and 9th P O days if prolonged preoperatively Give Vitamin K, 50 to 100 mg daily via I M or/and I V routes
2 Icteric Index—on 4th and 10th P O days
3 Penrose Drain—removed on or before 7th P O day, depending upon the amount of biliary drainage
4 Cholagogues (orally or I V) as ordered by Surgeon
5 Cevitamic acid—1000 mg daily

C **If gallbadder or biliary ducts are drained**

1 Immediately after surgery tie sterile glove to end of T-tube for collection of bile during transport of the patient Attach glove to dressings with safety pin When patient arrives in his room the glove is detached and the T-tube is connected to drainage bottle at bedside Use plastic I V tubing
2 Keep daily record of biliary drainage Intake and Output, Chart
   a) Color
   b) Viscosity
   c) Amount
3 Whenever necessary the collected bile may be returned to the body via Levin tube or proctoclysis When bile is returned by the latter route it is best diluted with Physiological Saline Solution The flow of bile may be increased by employing choloretics (i e Decholin Sodium), 5 to 10 cc daily for about 3 days
4 T-tube drainage—is routinely allowed to drain for 2 to 4 weeks or for as long as required (See Rules for Removing T tube)

6) Total Cholesterol
7) Cholesterol Esters

c) N P N and Blood Urea when
1) Icteric index is over 100
2) Evidence of renal disease co-exists
3) Jaundice has been unduly prolonged

d) Serum Iron (Elevated in Infectious Hepatitis, Normal or slightly elevated in obstructive jaundice)

10 **X-Ray Studies**
a) No dye studies are attempted in the presenc of jaun dice, (Cholecystogram or Cholograffin studies)
b) Flat film of abdomen (routine), Search for calculi

11 Stool to laboratory
a) Color
b) Bile and Urobilinogen
c) Occult Blood

B MANAGEMENT
1 SAME AS—"MANAGEMENT' UNDER "GALLBLAD DER WITHOUT JAUNDICE
2 Blood Transfusions—as required, especially where jaundice is severe or has been unduly prolonged
3 Order drainage bottle and I V plastic tubing for T-tube drainage at bedside also Levin-Wangensteen suction appa ratus

C MEDICATION
1 *Correct any existing deficiencies revealed in* **WORKUP**
2 Vitamin K Preparations, (i e) Synkavite, Vitamin K_1 (Merck), Synkamin or any other approved Vitamin K synthetic preparation Give I V I M or both ways We prefer Vitamin K_1 (Mephyton-Merck)
3 Bile salts—i e , Bilron, Decholin Metachol, Cholan HMB—with oral Vitamin K
4 Vitamin D (Viosterol) orally
a) In jaundice there is usually a faulty fat absorption and an associated poor fat-soluble-vitamin' absorption Therefore Vitamins A, D E and K are given prophylactically
5 Calcium Gluconate orally
6 *Check with patient for any antibiotic sensitivity, if not sensitive* give Combiotic—1 ampoule (full strength) I M , even ing before surgery (on Surgeon s order)
7 Night medication—(preferably ordered by Anesthesiologist), Phenobarbital grs 11 (hypo)
8 Scopolamine—gr 1/150 } 1 hr before surgery
Demerol—75-100 mg }

FACTS ABOUT GASTRIC ACIDITY

According to Best and Taylor the following variations in gastric acidity exist

1 In 100 subjects (medical students), 4% had Achlorhydria, (Anacidity) This figure is probably too high, 1 to 2% is probably nearer correct
2 In a general run of hospital cases, 14-20% had achlorhydria, (Anacidity)
3 The reasons for absence of free HCl are
   a) Excessive gastric neutralization, with no suppression of acid secretion
   b) 'Apparent Anacidity , (False Anacidity), this condition responds to Histamine stimulation 'True Anacidity" exists only when Histamine fails to stimulate secretion of free HCl
4 Alvarez, Vanzant, et al , found Anacidity to exist in 25-35% of patients 60 70 yrs of age, females slightly higher than men
5 The following pathological conditions are commonly associated with true Achlorhydria (Anacidity or Histamine-Achlorhydria)
   a) Carcinoma of the Stomach
      1) 70% show Anacidity, (No free HCl)
      2) 10% show 25-40° free acid
      3) 10% show 10-25° free acid
      4) 10% show 0-10° free acid
   b) Pernicious Anemia (P A)
   c) Chronic Gastritis
      1) Gradual depression of secretory function
   d) Other conditions which may be associated with Achlorhydria are
      1) Acute Fevers
      2) Malnutrition
      3) Gallbladder Pathology
      4) Addison s Disease
      5) Sprue and
      6) Chronic Arthritis
6 **High acid values by no means rule out gastric carcinoma**
7 A study by Canfort et al of the Mayo Clinic on 1000 gastric cases (779 benign gastric ulcers and 226 gastric cancers) revealed the following
   a) Gastric secretory activity in **benign gastric ulcer** does not vary with the size of the ulcer
   b) Gastric secretory activity in malignant gastric ulcer varies with the size of the neoplasm, i e , gastric acidity decreases as the size of the neoplasm increases
   c) The incidence of achlorhydria was smaller in benign gastric

5 RULES FOR REMOVING T-TUBE

1st Rule—Clamp T-tube at intervals During the clamp-off period there must be

a) No pain
b) No jaundice
c) No temperature elevation
d) No acholic stool
e) No chill

2nd Rule—Cholangiogram via T-tube

a) Diodrast (or Lipidol) must pass readily into the duodenum without showing any evidence of common duct obstruction

6 Surgeon removes T-tube only after the above criteria have been completely fulfilled

7 SEE—CHOLANGIOGRAPHY

8 In some patients in whom it has been necessary to remove the gallbladder, a catheter can be placed into the cystic duct and pushed into the common duct to be used as a form of drainage for the common duct In some patients we have found it useful to push the catheter even further—namely into the duodenum itself In such instances the ordinary catheter has served the same purpose as the recently introduced long arm T-tube In the latter case, the introduction of 5% Dextrose in Water or Physiological Saline Solution may be started immediately after the Cholecystectomy

D COMMENT

Other factors being favorable the postoperative recovery of a patient with a biliary tract lesion particularly one complicated by obstructive jaundice is dependent upon the ability of the liver to function adequately Hepatic damage is proportional to the degree and duration of the obstructive jaundice The liver is best fortified by an abundant administration of carbohydrate in the diet and dextrose parenterally Blood transfusions and oxygen are invaluable in supporting a badly damaged liver Oral proteins are best supplied by prescribing eggs, milk jello protein powdered supplements (i e) Meritene and eventually meat in its various forms Vitamins B C and K by oral and parenteral routes aid in carbohydrate metabolism wound healing and prevention of hemorrhage

GASTRIC ACIDITY DETERMINATIONS

Studies of Gastric Acidity have declined in popularity because of increasing reports on benign gastric ulcers without free acid and the presence of free acid in about 40% of cancers of the stomach The following tests of gastric secretion are still considered useful

I DIRECT METHODS OF DETERMINING FREE ACID

A FASTING GASTRIC ANALYSIS

1 When not contraindicated, i e gastric hemorrhage and perforation, the following tests should be done on all stomach cases both pre- and postoperatively
2 These tests should be done in the morning on a fasting stomach, (the patient receiving no food or liquids for 6 hours before the test)
3 The intern inserts a No 14 or 16 F Levin tube into the stomach via the nose The tube is left in place until all determinations are completed
   a) Aspirate contents of stomach using a 50 cc syringe
   b) Record quantity of aspirated material, this yields important information as to degree of gastric hypersecretion and gastric retention
   c) Mark specimen—FASTING SAMPLE
   d) Send at least 10 cc samples of specimen to laboratory for analysis
   e) Follow immediately with

B ALCOHOL TEST

1 Inject via stomach tube 200 cc of 2½% alcohol
2 Aspirate 10 cc samples of gastric content at the end of 30 and 60 minutes
3 Mark specimens—ALCOHOL TEST Record the times of aspiration
4 Send each 10 cc sample to laboratory, stat
5 Aspirate contents of stomach and discard after the 60 minute specimen is obtained
6 Follow immediately with

C HISTAMINE TEST

1 Inject 0 5 mg of Histamine hydrochloride subcutaneously
2 Aspirate the entire contents of stomach at end of 30 60 and 90 minutes
3 Mark specimens—HISTAMINE TEST Record the times on each specimen
4 Remove Levin tube at the end of 90 minute period

D INSULIN TEST OF HOLLANDER

This test is employed most commonly following a Vagotomy to determine if all Vagi motor and secretory fibers to the stomach have been completely severed This test depends upon the fact

ulcer with a typical history of ulcer, and greater in those with an atypical history

d) In cases of gastric ulcer and small gastric cancer in which the longest diameter measured 2 cms or less the gastric secretory activity was almost similar

Rider et al *, after a five year clinical study of 2000 cases of gastric analysis, summarized his findings as follows

1. The level of gastric acidity is clinically significant in
   a) Duodenal Ulcer—High
   b) Hypertrophic Gastritis—High
   c) Gastric Ulcer—Normal
   d) Gastric Carcinoma—Low
   e) Post-gastric Resection—Low
   f) Atrophic gastritis—Low
   g) Pernicious anemia—Absent
2. Betazole Hydrochloride (Histalog), is more effective stimulant of gastric acidity than Histamine
3. Routine gastric cytology is invaluable in the diagnosis of cancer

*J Alfred Rider H C Moeller J O Gibbs J Swader L O Agcaoli J Lee R.G Devereaux and Ernesto Puletti Gastro-intestinal Clinic of Dept of Medicine University of California School of Medicine San Francisco 1958

NOTES

GASTRIC ACIDITY DETERMINATIONS

Studies of Gastric Acidity have declined in popularity because of increasing reports on benign gastric ulcers without free acid and the presence of free acid in about 40% of cancers of the stomach The following tests of gastric secretion are still considered useful

I DIRECT METHODS OF DETERMINING FREE ACID

A FASTING GASTRIC ANALYSIS

1 When not contraindicated, i e gastric hemorrhage and perforation, the following tests should be done on all stomach cases both pre- and postoperatively
2 These tests should be done in the morning, on a fasting stomach, (the patient receiving no food or liquids for 6 hours before the test)
3 The intern inserts a No 14 or 16 F Levin tube into the stomach via the nose The tube is left in place until all determinations are completed
   a) Aspirate contents of stomach using a 50 cc syringe
   b) Record quantity of aspirated material, this yields important information as to degree of gastric hypersecretion and gastric retention
   c) Mark specimen—FASTING SAMPLE
   d) Send at least 10 cc samples of specimen to laboratory for analysis
   e) Follow immediately with

B ALCOHOL TEST

1 Inject via stomach tube 200 cc of 2½% alcohol
2 Aspirate 10 cc samples of gastric content at the end of 30 and 60 minutes
3 Mark specimens—ALCOHOL TEST Record the times of aspiration
4 Send each 10 cc sample to laboratory, stat
5 Aspirate contents of stomach and discard after the 60 minute specimen is obtained
6 Follow immediately with

C HISTAMINE TEST

1 Inject 0 5 mg of Histamine hydrochloride subcutaneously
2 Aspirate the entire contents of stomach at end of 30, 60 and 90 minutes
3 Mark specimens—HISTAMINE TEST Record the times on each specimen
4 Remove Levin tube at the end of 90 minute period

D INSULIN TEST OF HOLLANDER

This test is employed most commonly following a Vagotomy to determine if all Vagi motor and secretory fibers to the stomach have been completely severed This test depends upon the fact

that the hypoglycemia induced by an adequate dosage of Insulin, stimulates the Vagi motor and secretory fibers to the stomach by its affect on the Central Nervous System, (Cephalic Phase)

1 40 80 units of Insulin in a normal adult produces a fall in blood sugar (hypoglycemia) to 40 mg per 100 cc or lower In approximately ½ to 1 hr a marked increase in the rate and acidity of the stomach s fasting secretion results (Avoid profound hypoglycemia since no vagal stimulation will occur)
2 The above test is controlled by blood sugar determinations before and 1 hr after the Insulin injection The blood sugar should fall to 50 mgs /100 cc or less if Vagal stimulation is to occur
3 Interpretation of Hollander s Test after Vagotomy
   a) Complete Vagotomy
      1) No acid response to Insulin-induced-hypoglycemia "
   b) Incomplete Vagotomy
      1) Acid response to Insulin induced hypoglycemia
   c) Complete-Incomplete Vagotomy
      1) A patient may test Complete after Vagotomy and *months later test 'Incomplete", this may possibly be* due to nerve regeneration

II INDIRECT METHODS OF DETERMINING FREE ACID

The value of indirect tests of gastric secretion lies in pointing toward **gastric atrophy** The incidence of gastric carcinoma in patients with achlorhydria is about 1% the incidence of gastric carcinoma in gastric atrophy is about 6% Diagnostic acuity will be enhanced by using the **Pepsin** and **Intrinsic Factor Tests** It is significant that stomach Ca is 3x more frequent in blood relatives of patients with pernicious anemia

A **Quinine Carbacrylic Resin** (SEGAL TEST)
1 Patient swallows the **indicator resin complex,** (an indicator bound to an exchange-resin so that the bond holding the two is dissolved at an acid pH
2 If acid is present in the stomach the indicator is released to be absorbed and excreted in the urine Instead of Quinine-Azure-A, blue dye may be used if patient s urine turns blue within 3 hrs free acid is present If the urine does not turn blue even after boiling with acid clinically no free acid is present
   a) It is important that the dye should not pass too rapidly through the stomach or a **false negative test** may be reported

B PEPSIN MEASUREMENTS
1 The **chief cells** of the stomach secrete pepsin into the stomach and a lesser amount into the bloodstream

2. Tests for blood pepsin and urine pepsin are available to study gastric secretion
3. Normal blood pepsin varies from 200-450 units
   a) Higher blood pepsin levels are found in gastric and duodenal ulcers, though they only denote **hypersecretion** Hypersecretion of pepsin may indicate the existence of a digestive erosion factor in hiatus hernia, esophageal stricture, etc Hypersecretion rules out Pernicious Anemia and gastric atrophy
   b) Low levels of blood pepsin implies decreased gastric secretion as in post-gastric resection, gastric atrophy and Pernicious Anemia

C. TESTS DEPENDING ON INTRINSIC FACTOR

1. Vitamin B_{12}—(Cyanocobalamin)—is absorbed in significant amounts only if intrinsic factor is present
2. Schilling Test—Radioactive Vitamin B_{12} is given orally If intrinsic factor is present, radioactive Vitamin B_1 is found in the urine
   a) Achlorhydria patients excrete normal amounts
   b) Pernicious Anemia patients excrete minimal amounts

NOTES

GASTRIC ACIDITY DETERMINATIONS

	FASTING	1 HR EWALD
A NORMAL		
1 Total Acidity	15-45°	50 70°
2 Combined Acidity	10-15°	20-30°
3 Free HCl	0-30	25-50°
B HYPERCHLORHYDRIA		
1 Total Acidity	55° or more	90° or more
2 Combined Acidity		
3 Free HCl	40° or more	75° or more
C HYPOCHLORHYDRIA		
1 Total Acidity	15° or less	40° or less
2 Combined Acidity		
3 Free HCl	Under 25° throughout	

D ACHLORHYDRIA

No free Hydrochloric Acid—pepsin is present

E ACHYLIA GASTRICA

Absence of free hydrochloric acid and pepsin

NOTES

CYTOLOGIC METHOD IN DIAGNOSIS OF STOMACH CARCINOMA

PAPANICOLAOU'S METHOD

Carcinoma of the stomach is usually moderately advanced before it produces symptoms One should seek a means of detecting the disease in its earliest possible pre-symptomatic stage Papanicolaou's method is based on the observation that most malignant growths desquamate cells which can be identified after suitable fixation and staining

METHODS OF GASTRIC ASPIRATION

A ALCOHOL FIXATION METHOD

1 Nothing by mouth for 8 hrs prior to test
2 Levin or Rehfuss tube may be used
3 Patient is in sitting position
4 Do not allow patient to swallow water during passage of tube
5 Aspirate total gastric content
6 Add to bottle containing 100 cc of 95% alcohol (Ethyl, isopropyl or methyl)
7 Send specimen to laboratory immediately
  a) **Malignant cells are usually digested in ½ hr.**

B RINGER SOLUTION METHOD

1 After tube is inserted, allow patient to swallow 8 oz of Ringer's Solution
2 Aspirate total gastric content
  a) No alcohol fixative needed
3 Send specimen to laboratory immediately
  a) **Malignant cells undergo disintegration in approximately ½ hr**

C LABORATORY PROCEDURE

Whether method A or B is used—specimen is centrifuged immediately

1 Sediment is spread on slide
2 Fix at once in 50 50 Solution of ethyl ether and 95% alcohol
3 Stain with Papanicolaou's Stain after 15 minute fixation

D CYTOLOGY OF GASTRIC SECRETION

1 NORMAL CELLS
  a) Most cells originate in the squamous mucous epithelium of the upper gastrointestinal and pulmonary tracts
  b) Cells are large with clear cytoplasm and vesicular nuclei
  c) Gastric mucosal cells are columnar or cuboidal with a small vesicular eccentric nucleus
  d) Cells have distinct borders and distinct nuclei

2 MALIGNANT CELLS
  a) CELLS—often appear in groups, occasionally singly
  b) NUCLEI—are hyperchromatic and contain prominent nucleoli

1) Single cells contain large hyperchromatic nuclei and inadequate cytoplasm

c) CELL BORDERS—not distinct

d) CYTOPLASM—characteristic vacuolization often occurs in the cytoplasm of malignant cells

NOTES

ROUTINE FOR GASTROSCOPIC EXAMINATIONS

I PREPARATION OF STOMACH

A On night before Gastroscopic Examination

1) Light non residue supper which is to be taken not later than 6 00 P M

2) In cases of retention of six hours or more, the stomach should be emptied between 10 00 P M and 12 00 midnight (Use large tube, head of patient is lowered, and the stomach empties by gravity)

3) Do not Lavage stomach during drainage, or for 24 hrs before gastroscopy

II ORAL HYGIENE

A After stomach is emptied

1) Teeth are brushed

2) Alkaline mouth washes q 3 hrs

III GENERAL PREPARATION

A On night before examination

1) No morphine or narcotics are given to patient

IV ON MORNING OF EXAMINATION

A Local preparation

1) Remove dentures plates or any foreign objects in the mouth

2) Teeth are brushed

3) Alkaline mouth washes, hourly

B Send patient to gastroscopic room with

1) Chart

2) X-Ray films

3) All pertinent laboratory data

NOTES

GASTRIC DECOMPRESSION

PURPOSE OF GASTRIC DECOMPRESSION

If an obstruction exists which interferes with the emptying of the stomach, the stomach becomes more **muscular** in the muscular portion and **dilated** in the less muscular portion Associated with this hypertrophy and dilatation, there is **edema** of the stomach wall Because of the difficulties in determining where to **place** the artificial stoma in a gastro-jejunostomy and in order to have a wall which is not **edematous and can be accurately and effectively sutured,** it is necessary to determine the Pyloric Balance This procedure is both **diagnostic and therapeutic**

I **Negative Pyloric Balance**—When amount aspirated is greater than amount given by mouth
  A) The **greater** amount aspirated is due to "accumulated' gastric secretion or duodenal reflux
  B) **If graph curve reveals a "negative balance," there** probably is a complete obstruction and Levine suction should be kept in place to prevent the stomach from becoming hypertrophied, dilated and edematous

II **Positive Pyloric Balance**—When amount aspirated is **less** than amount given by mouth
  A) The **lesser amount** aspirated is due to the stomach's ability to propel and evacuate the material into the duodenum, (the stomach has negligible absorptive power)
  B) When the graph curve shows a 'positive balance' (above zero line), an optimum time to operate exists because the stomach is now emptying and the tone is usually established

INSTRUCTIONS TO NURSES

The aspiration apparatus remains shut off during the first 3 hours and 40 minutes of a four hour period Fluids in small amounts are given and recorded on the data sheet In the last 20 minutes of the **four hour period** the siphonage is started to see how much remains in the stomach and how much has **passed through** into the duodenum

The Pyloric Balance is determined by the **difference** between the amount given by mouth and the amount aspirated This determines whether it is a negative or positive pyloric balance If the amount aspirated is **greater,** it is **negative,** if the amount aspirated is **less,** it is **positive**

The Pyloric Balance per hour is determined by dividing the pyloric balance by the number of hours during which the suction is stopped

Example

	Amount given by mouth	Aspirated Amount	Total 4 hour Pyloric Balance	Pyloric Bal. Per Hour
4 hr interval	12 oz.	92 oz	−80 oz.	−20 oz

The patient has a **Negative Pyloric Balance,** this means patient is not ready for oral feedings, Levin-Wangensteen suction must be continued until Pyloric Balance becomes Positive

NOTES

ORDERS FOR STOMACH CASES

On admission, the patient falls into one of four classes

I PERFORATION
II HEMORRHAGE
III STENOSIS
IV DIAGNOSTIC

The **workup** and **treatment** vary accordingly

I PERFORATION—History, signs and symptoms usually suggest such a complication

The attending surgeon is notified immediately if a diagnosis of perforation is made The surgeon should arrange for operation without delay The expired time between perforation and operation must be cut to a minimum to insure the best results and lowest mortality Results are usually excellent under 6 hours Do not *forget that carcinoma of the stomach may also perforate* **All gastric ulcers should be biopsied**

A PREOPERATIVE ORDERS

The patient is put to bed and disturbed as little as possible General Bathing etc , can be done later A brief but careful physical examination is made Include the factors which will give an estimate of the immediate operative risk Record examination of heart, lungs, abdomen and laboratory findings

1 MANAGEMENT (IMMEDIATE—BEFORE DIAGNOSIS)

a) Begin treatment of shock—stat!
b) No enema
c) Nothing by mouth
d) Patient should lie on left side to prevent leakage from hole in stomach or duodenum **Stomach aspiration is done prior to surgery**

2 WORKUP (EMERGENCY LABORATORY)

a) Complete blood count
b) Urinalysis (catheterized specimen if necessary)
c) Wassermann or Kahn
d) Type and cross match patient, have compatible donors available Have 2 pints of blood in bank
e) Blood Cevitamic Acid
f) Total blood protein, A/G Ratio

These patients usually have had long standing dietary imbalances especially protein and vitamins Either they have starved themselves voluntarily because of a sitophobia or because their prescribed diet to relieve gastric distress was inadequate A patient with a total blood protein (below 6 Gms /100 cc) or a reversed A/G Ratio is considered a poor risk These

patients usually develop generalized hypoproteinemic edema, that is, edema of the gastroenterostomy with consequent obstruction of the new stoma Nausea, vomiting and possible rupture of the suture line may follow Kidney edema may produce a nephrotic syndrome with oliguria or anuria A deficient tissue collagenic response with poor wound healing is a common occurrence

g) X-Rays—Fat films of the abdomen are ordered
Three views
1) Patient lying on left side,
2) Lying on back, and
3) Sitting up or upright
A subdiaphragmatic shifting bubble of air is pathognomonic of a ruptured hollow viscus

3 MEDICATION

a) Morphine sulphate gr ⅙ } 1 hr before surgery
Scopolamine gr 1/150 }
b) Penicillin Streptomycin, or Aureomycin on surgeon s order

4 MANAGEMENT (ROUTINE—AFTER DIAGNOSIS)

a) Prep Abomino perineal (from nipples to mid thighs)
b) On call to O R 15 minutes before scheduled surgery

B IN OPERATING ROOM

1 Physiological Saline Solution I V Blood or plasma given if necessary
2 Culture peritoneal fluid in all cases, order sensitivity studies
3 Biopsy all gastric ulcers
4 Close defect and reserve definitive surgery for a later date
5 *Gastric Resection may be considered on occasion*

C POSTOPERATIVE ORDERS

Postoperative routine same for all gastric cases
See Postoperative Orders for Gastric Cases

II HEMORRHAGE

Patients with a history of no recent major hemorrhage or those in whom only occult blood has been found in the stools

A PREOPERATIVE ORDERS

1 WORKUP

a) Complete blood count
b) Urinalysis
c) Wassermann or Kahn
d) Stools examined daily until negative for blood

e) X-Ray (Barium meal considered safe at this time)
Colon X-Ray on order of surgeon
f) *Type patient and cross match Have compatible donors available* Have 4 pints of blood in bank
g) Prothrombin Time
h) Blood Cevitamic Acid
i) A/G Ratio
j) Liver Function Tests
1) Cephalin-Flocculation
2) Thymol Turbidity
3) Bromsulphathalein

2 MEDICATION

a) Morphine sulphate gr 1/6, Scopolamine gr 1/150 } 1 hr before surgery
b) Vitamin K-30 mg (I M) stat, 30 mg B I D
c) Cevitamic Acid—1000 mg daily
d) Penicillin Streptomycin and Chloromycetin on order of surgeon

3 MANAGEMENT

a) Suitable diet during period of observation
b) Regular attention to bowels Anti-ulcer management continued by internist during period of observation
c) Mouth hygiene, (mouth washes)
d) S S enema unless contraindicated
e) Nothing by mouth after 6 P M except water, no water after midnight
f) Patient goes to surgery with indwelling Levin tube, 16F rubber (Avoid plastic Levin tube if possible*)
g) Prep abdomino perineal (from nipples to mid thighs)
h) On call to O R 15 minutes before scheduled surgery
i) *If patient is scheduled electively in the afternoon—I V solutions should be started in the A M to prevent hours of avoidable dehydration*

*Plastic tubes are undesirable because of stiffness They have been known to perforate the stomach wall

II (a) **A RECENT MAJOR HEMORRHAGE,** or repeated small hemorrhages These patients do not require immediate surgery, seldom is emergency operation indicated to control a minor hemorrhage Treatment aims at decreasing the chance of further bleeding sustaining life until the emergency has passed and then dealing with the source of bleeding Have adequate amounts of fresh whole blood ready to transfuse when necessary

A PREOPERATIVE ORDERS

1 WORKUP

a) Complete blood count—(repeat q 4-8 hrs until hemorrhage is controlled) Hematocrit and hemoglobin readings charted, note time

b) Urinalysis (complete)

c) Wassermann or Kahn

d) Type and cross-match patient, obtain compatible donors have 4 units of blood in bank at all times

e) Stool to laboratory for blood q 2 days

f) Blood Cevitamic Acid

g) A/G Ratio

h) Prothrombin Time

i) X-Ray examination with Barium is preferably not done until one or two weeks after hemorrhage, unless urgency demands it be done sooner or during the active bleeding phase

j) Liver function tests

1) Cephalin Flocculation

2) Thymol turbidity

3) Bromsulphalein

4) Alkaline Phosphatase

2 MEDICATION

a) Morphine sulphate gr 1/6 (repeat if necessary to keep patient quiet)

b) Morphine sulphate 1/6 gr, Scopolamine 1/150 gr } 1 hr before surgery

c) Cevitamic Acid—1000 mg daily, (hypo)

d) H_2O_2 mouth washes t i d

e) Vitamin K_1—(Mephyton-Merck) 50 mg (I M) stat 50 mg B I D

3 MANAGEMENT

a) Nothing by mouth for 48 hrs after cessation of hemorrhage, then sterile water in small quantities

b) Dorsal position elevate foot of bed keep patient warm, take B P and pulse readings q 15 min until stabilized

c) Careful attention to mouth hygiene (See Medication)

e) X-Ray (Barium meal considered safe at this time)
Colon X-Ray on order of surgeon
f) Type patient and cross-match Have compatible donors available Have 4 pints of blood in bank
g) Prothrombin Time
h) Blood Cevitamic Acid
i) A/G Ratio
j) Liver Function Tests
1) Cephalin Flocculation
2) Thymol Turbidity
3) Bromsulphathalein

2 MEDICATION

a) Morphine sulphate gr 1/6, Scopolamine gr 1/150 } 1 hr before surgery
b) Vitamin K-30 mg (I M) stat, 30 mg B I D
c) Cevitamic Acid—1000 mg daily
d) Penicillin, Streptomycin and Chloromycetin on order of surgeon

3 MANAGEMENT

a) Suitable diet during period of observation
b) Regular attention to bowels Anti ulcer management continued by internist during period of observation
c) Mouth hygiene (mouth washes)
d) S S enema unless contraindicated
e) Nothing by mouth after 6 P M except water, no water after midnight
f) Patient goes to surgery with indwelling Levin tube, 16F, rubber (Avoid plastic Levin tube if possible*)
g) Prep abdomino perineal (from nipples to mid-thighs)
h) On call to O R 15 minutes before scheduled surgery
i) If patient is scheduled electively in the afternoon—I V solutions should be started in the A.M to prevent hours of avoidable dehydration

*Plastic tubes are undesirable because of stiffness They have been known to perforate the stomach wall.

An emergency barium study may reveal an ulcer, esophageal varices, gastric carcinoma or polyps If X-Rays fail to establish a diagnosis, the best results remain on the side of conservative management Umbrathor (thin barium) may be used instead of barium

h) Prothrombin Time

i) Blood Cevitamic Acid

j) *LIVER FUNCTION TESTS—may indicate impaired* liver function, the presence of liver cirrhosis implies hemorrhage from esophageal varices, (See recommended liver tests)

2 **MEDICATION**

a) Mouthwashes—(H_2O_2) t i d

b) Cevitamic Acid—1000 mg daily, (hypo)

c) Vitamin K_1—(Mephyton Merck) 50 mg (I M) stat, 50 mg B I D

d) Morphine sulphate gr 1/6 } 1 hr before surgery
Scopolamine gr 1/150 }

e) Penicillin, Streptomycin, or Chloromycetin—on order of surgeon

f) Give 10 cc of 10% Calcium gluconate, (I V) after every (1 or 2) transfusions of citrated blood

g) We have had indifferent results with systemic hemostatics

h) **McNealy Glassman "Anticoagulant Cocktail"**

1) Powdered gelfoam—2 tablespoonsful

2) Thromboplastin—10 cc

3) Gelusil or Amphojel Solution—q s ad to make 1 to 1½ fl ozs—thin enough to flow easily through the tube

The cocktail" is instilled via Levin tube—and the tube is washed out immediately with 10 cc sterile water before clamping Repeat "cocktail q 4 hrs

3 **MANAGEMENT**

a) Check B P and Pulse q 15 minutes until stabilized, then q 30 minutes 4 times, then q 1 hr 4 times, thereafter q 3 hrs

b) Encourage deep breathing coughing, kicking and 'side to side turning

c) Nothing by mouth

d) Dorsal position elevate foot of bed keep patient warm

e) Careful attention to mouth hygiene

f) **Whole Blood Transfusions**

d) Severe post-hemorrhagic anemia and low blood pressure (below 100 systolic) indicates prompt whole blood transfusions GIVE BLOOD BY DROP METHOD 500 cc q 8 hrs is desirable, in some instances 1000 cc (or more), q 8 hrs may be required

e) S S enema—night before surgery unless contraindicated

f) Patient goes to surgery with indwelling Levin tube 16-18F, rubber

g) Prep abdomino perineal (from nipples to mid thigh)

h) On call to O R 15 minutes before scheduled surgery

II (b) ***MASSIVE HEMORRHAGE***—or exanguinating hemorrhage is a surgical emergency The outlook in these patients is grave **THE UTMOST CO OPERATION BETWEEN INTERNIST AND SURGEON IS IMPERATIVE**

There must be no conflict between conservative and surgical management in these cases Procrastination only serves to further increase the mortality Without surgical intervention these patients usually die Those who survive operation represent pure salvage **CONTINUOUS BLEEDING IS NOT AS IMPORTANT AS THE RATE AND AMOUNT OF BLEEDING** Factors influencing immediate surgical intervention in Massive Hemorrhage are

A Failure to maintain a stabilized circulation despite rapid and adequate blood replacement, (1500 5000 cc q 24 hrs)

B Recurring syncope (i e) fainting sweating hypotension B P below 100 systolic despite blood replacement

C Failure to maintain Hematocrit of at least 30

D Patients over 45 years of age

A PREOPERATIVE ORDERS

1 WORKUP

a) Complete blood count, (R B C below 2,000,000 is very serious) Continue with blood transfusions

b) Hematocrit readings—q 2 hrs (Hematocrit constantly below 30 is very serious)

c) Urinalysis

d) Wassermann or Kahn

e) Stool—examined for blood

f) Type and cross match have as many donors as possible standing by Hold 4 to 8 pints of blood in bank alert nearby blood banks if patient has rare blood

g) X-Ray when no history can be obtained emergency X-Ray studies may be done if patient is not in shock

III STENOSIS

Patients in whom PYLORIC OBSTRUCTION of any degree is suspected or found to be present

These patients should be thoroughly investigated **THEIR STOMACHS MUST BE DECOMPRESSED PRIOR TO SURGERY** Preoperative treatment aims at re-establishing the patient s nutritional fluid, mineral and vitamin balance, and restoring the stomach to normal size, shape and tone The colon must be thoroughly cleansed with repeated enemas until all residual barium and feces are washed out Fluoroscopic examination must be done on all bowel and gastric cases before surgery to eliminate any possibility of the presence of inspissated barium in the G-I tract

A PREOPERATIVE ORDERS

1 WORKUP

a) Complete blood count
b) Urinalysis
c) Wassermann or Kahn
d) Stool to laboratory for blood
e) Blood Cevitamic Acid
f) Type and cross match patient, obtain compatible donors, have 2 pints of blood in bank
g) Prothrombin Time
h) Record fluid Intake and Output, keep a fluid balance graph (See Fluid Balance Chart)
i) A/G Ratio
j) Gastric Acidity determinations, (See— Gastric-Determinations ')
k) Papanicolaou s Stained Cell Studies (See ' Papanicolaou s Technic)
l) Liver Function Tests
   1) Cephalin Flocculation
   2) Thymol Turbidity
   3) Bromsulphalein

2 MEDICATION

a) Urecholine—10 mg orally, t i d
b) Doryl—2-4 mg orally t i d
c) Strychnine sulphate gr 1/30 orally, t i d (for 5 days before operation—to increase tone of gastric musculature)
d) Dilute HCl minims 30 t i d for 5 days before operation (if free acid is low or absent)
e) Cevitamic acid 1000 mg daily, (hypo)
f) Vitamin K_1 if indicated, 40 mg (I M) stat , and 40 mg b i d

1) 500 cc q 8 hrs or 1500 cc in 24 hrs is the usual rate of replacement, when the rate of hemorrhage is excessive, 3000 cc in 24 hrs (or more), may be required
2) Surgery is preferably carried out when the circulation is stabilized TRANSFUSIONS ARE CONTINUED UNTIL SOURCE OF BLEEDING IS SURGICALLY CONTROLLED It may be necessary in cases that fail to stabilize—to operate as the blood is being replaced—and as soon as the patient is out of shock

g) Warm saline enema before surgery—on order of surgeon
h) Gastric Siphonage—is employed to determine the character of gastric and duodenal content If the aspirated material contains bile, mucus and no blood—bleeding has stopped, if fresh blood is aspirated,—bleeding is still active Aspiration of gastric juice may prevent digestion of clot at bleeding site The Coagulant Cocktail' also tends to do this
i) Prep abdomino-perineal, (from nipples to mid thighs)
j) On call to O R 15 minutes before scheduled surgery
k) Transfusion is kept running—preferably via a cut-down employing a polyethylene catheter

NOTES

be guided by the relative importance of various factors in the individual case These factors are the site, extent and chronicity of the lession, the accompanying effect of the lesion, such as, gastric retention, hyperacidity and hypersecretion, fistulous communication with adjoining viscera, etc, the previous medical or surgical history and management the patient s general condition age and response to present conservative management

IN NO CASE OF SUSPECTED ULCER OR CARCINOMA SHOULD ALCOHOL OR TOBACCO IN ANY FORM BE ALLOWED

During the investigation, the patient should have a dental examination, the teeth scaled and cleaned, carious teeth and roots removed on order of surgeon The mouth must be put in the best possible condition prior to operation The colon must be thoroughly cleansed with enemas, to eliminate any residual barium from previous X-Ray examinations

A PREOPERATIVE ORDERS

1 WORKUP

a) Complete blood count
b) Urinalysis
c) Wassermann or Kahn
d) Stool to laboratory for gross or microscopic blood pus, mucus, parasites etc
e) Blood Cevitamic Acid
f) Type patient and cross-match obtain compatible donors, have 4 pints of blood in bank
g) X-Rays, complete G I series, Gall bladder study
h) Gastric acidity determinations Papanicolaou cell stain studies Gastroscopic study on order of surgeon
i) Record fluid Intake and Output on fluid balance graph (See—Fluid Balance Chart)
j) A/G Ratio
k) Prothrombin Time
l) Fluoroscope patient on day before surgery to see that all barium is out of gastro intestinal tract
m) **Liver Function Tests**
   1) Cephalin-Flocculation Test
   2) Thymol Turbidity
   3) Bromsulphalein
   4) Alkaline Phosphatase

2 MEDICATION

a) Cevitamic Acid 1000 mg daily, (orally or hypo)
b) Multi-vitamin capsules Prophylactic or Therapeutic —depending on need

g) H_2O_2 mouth washes t i d

h) Morphine sulphate—gr 1/6 } 1 hr before
Scopolamine—gr 1/150 } surgery

i) Antibiotics on surgeon's order,

3 MANAGEMENT

a) Preoperative gastric decompression; most important!

b) PYLORIC BALANCE TEST

1) Wash stomach with sodium bicarbonate solution (oz 1 to H_2O 1 quart) until returns are clear, use large tube, 18F, rubber

2) Insert Levin tube and connect with Wangensteen apparatus, continuous

3) Give ounce of water, cooked fruit juices or other clear liquid (not milk), every hour

4) Calculate "Pyloric Balance" on record sheet and chart (See—Pyloric Balance Chart)

5) Save material aspirated from stomach, examine and measure

6) When "Pyloric Balance" becomes positive—i e when less gastric content is aspirated than is instilled, the patient is usually ready for surgery (See "Pyloric Balance Test" under "Gastric Decompression",

c) Enema—S S once or twice daily for 3 days before surgery, then every 4 hours on day before surgery until returns are clear

d) Fluids—3000 cc daily, total intake should if possible exceed total output by 1000 cc Parenteral fluids with nutrients are given I V up to time of surgery

1) Glucose or fructose solution is preferred because it increases caloric intake 5 10% Dextrose in water, Travert—(10% Invert Sugar) is excellent

2) Physiological Saline Solution should be given daily to restore sodium and chlorides, add vitamins and KCl as needed

3) Protein solution is given as protein hydrolysates, 5%, amino acids, (i e) Amigen, Aminosol, etc

4) Potassium—is given as 0 3% I V to replenish K+ lost by constant suction (40 mEq/L, or (3 Gms) to 1 liter

IV DIAGNOSTIC—Patients in whom no hemorrhage has occurred, though ulcer symptoms have been present—or in whom carcinoma is suspected

These cases are to be investigated fully Operative interference in cases of peptic ulcer and carcinoma of the stomach will

be guided by the relative importance of various factors in the individual case These factors are the site, extent and chronicity of the lession, the accompanying effect of the lesion, such as, gastric retention, hyperacidity and hypersecretion, fistulous communication with adjoining viscera, etc, the previous medical or surgical history and management, the patient's general condition, age and response to present conservative management

IN NO CASE OF SUSPECTED ULCER OR CARCINOMA SHOULD ALCOHOL OR TOBACCO IN ANY FORM BE ALLOWED

During the investigation, the patient should have a dental examination the teeth scaled and cleaned, carious teeth and roots removed on order of surgeon The mouth must be put in the best possible condition prior to operation The colon must be thoroughly cleansed with enemas to eliminate any residual barium from previous X-Ray examinations

A PREOPERATIVE ORDERS

1 **WORKUP**

a) Complete blood count
b) Urinalysis
c) Wassermann or Kahn
d) Stool to laboratory for gross or microscopic blood pus, mucus parasites, etc
e) *Blood Cevitamic Acid*
f) Type patient and cross match, obtain compatible donors have 4 pints of blood in bank
g) X-Rays complete G-I series, Gall bladder study
h) Gastric acidity determinations Papanicolaou cell stain studies Gastroscopic study on order of surgeon
i) Record fluid Intake and Output on fluid balance graph (See—Fluid Balance Chart)
j) A/G Ratio
k) Prothrombin Time
l) Fluoroscope patient on day before surgery to see that all barium is out of gastro intestinal tract
m) **Liver Function Tests**
 1) Cephalin-Flocculation Test
 2) Thymol Turbidity
 3) Bromsulphalein
 4) Alkaline Phosphatase

2 **MEDICATION**

a) Cevitamic Acid 1000 mg daily (orally or hypo)
b) Multi vitamin capsules Prophylactic or Therapeutic —depending on need

g) H_2O mouth washes t i d
h) Morphine sulphate—gr 1/6 } 1 hr before
Scopolamine—gr 1/150 } surgery
i) Antibiotics on surgeon s order

3 MANAGEMENT

a) **Preoperative gastric decompression, most important'**
b) **PYLORIC BALANCE TEST**
1) Wash stomach with sodium bicarbonate solution (oz 1 to H_2O 1 quart) until returns are clear, use large tube 18F rubber
2) Insert Levin tube and connect with Wangensteen apparatus, continuous
3) Give ounce of water cooked fruit juices or other clear liquid (not milk) every hour
4) Calculate ' Pyloric Balance ' on record sheet and chart (See—Pyloric Balance Chart)
5) Save material aspirated from stomach examine and measure
6) When "Pyloric Balance ' becomes positive—i e when less gastric content is aspirated than is instilled the patient is usually ready for surgery (See Pyloric Balance Test' under **"Gastric Decompression"**
c) **Enema**—S S once or twice daily for 3 days before surgery then every 4 hours on day before surgery until returns are clear
d) **Fluids**—3000 cc daily, total intake should if possible exceed total output by 1000 cc Parenteral fluids with nutrients are given I V up to time of surgery
1) Glucose or fructose solution is preferred because it increases caloric intake 5-10% Dextrose in water Travert—(10% Invert Sugar) is excellent
2) Physiological Saline Solution should be given daily to restore sodium and chlorides, add vitamins and KCl as needed
3) Protein solution is given as protein hydrolysates, 5% amino acids (i e) Amigen Aminosol, etc
4) Potassium—is given as 0 3% I V to replenish *K+ lost by constant suction (40 mEq/L , or* (3 Gms) to 1 liter

IV **DIAGNOSTIC**—Patients in whom no hemorrhage has occurred though ulcer symptoms have been present—or in whom carcinoma is suspected

These cases are to be investigated fully Operative interference in cases of peptic ulcer and carcinoma of the stomach will

*PYLORIC BALANCE CHART

(Chart figures below)

DAY	−100	−90	−80	−70	−60	−50	−40	−30	−20	−10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										

DATA FROM WHICH GRAPH OF PYLORIC BALANCE IS MADE

Patient s Name ______________________________

Date of Admission ______________________________

Diagnosis ______________________________

Date	Interval	Am t Given By Mouth	Amount Aspirated	*Pyloric Balance	Pyloric Balance/Hr
	12M 4AM				
	4AM-8AM				
	8AM 12 Noon				
	12 Noon-4PM				
	4PM-8PM				
	8PM-12M				
	12M 4AM				
	4AM-8AM				
	8AM-12 Noon				
	12 Noon 4PM				
	4PM-8PM				
	8PM-12M				
	12M-4AM				
	4AM 8AM				
	8AM-12 Noon				
	12 Noon-4PM				
	4PM-8PM				
	8PM-12M				

*PYLORIC BALANCE CHART

(Chart figures below)

DAY	−100	−90	−80	−70	−60	−50	−40	−30	−20	−10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										
											8										
											12										
											4										

c) Vitamin K_1*—(Mephyton-Merck) if indicated 50 mg stat, and 50 mg b i d until time of surgery
d) Dilute HCl—minims 30 t i d for 5 days before operation (if absent or low free acid exists)
e) H_2O_2 mouth washes t i d
f) Phenobarbital gr 1 (hypo) at 10 P M nite before surgery
g) Morphine sulphate gr 1/6 } 1 hr before surgery
   Scopolamine gr 1/150 }
h) Penicillin, Streptomycin or Chloromycetin on order of surgeon

3 MANAGEMENT

a) Suitable diet depending on severity and duration of symptoms
b) 3000 cc of fluids per day should be attained If oral intake is inadequate, supplement with parenteral fluids (5% Dextrose in water Travert 10%, Physiological Saline Solution or Protein Hydrolysates
c) Blood transfusions—if indicated
d) S S enema—once or twice daily for 3 days before surgery—continue until returns are clear
e) Nothing by mouth after 6 P M except water no water after midnight
f) Patient goes to surgery with indwelling Levin tube 16 or 18F, rubber

*KONAKION (Roche)—is a new synthetic Vitamin K_1—it may be given I V I M or orally Konakion is a brand of phytonadione

NOTES

POSTOPERATIVE PROCEDURE FOR ALL GASTRIC CASES

A MANAGEMENT

1. Check B P and Pulse q 15 minutes until stabilized, then q 30 minutes 4x, then q 1 hr 4x, then q 3 hrs thereafter, record
2. Change position of patient q ½ hr for 6 hrs and q 1 hr thereafter Encourage deep breathing, coughing, kicking and side-to-side turning Ace-Elastic Bandages applied routinely to lower extremities on all patients over 60 yrs of age
3. Continuous suction with Levin-Wangensteen setup
   a) Check tube regularly for patency, use 50 cc syringe and sterile distilled water for clearing out plugs
   b) Check connections and all other parts of the suction apparatus Break connections q ½ hr routinely
   c) Allow sips of water while suction is on Record Intake and Output, chart
4. **Remove Levin tube when**
   a) Less than 200 cc of residual gastric content is aspirated See—"Pyloric Balance Test'
5. Catheterize for bladder distention q 8-10 hrs P R N use sterile precautions both locally and systemically Antibiotics—on order of surgeon
6. I V FLUIDS—3 liters daily, plus whatever amounts are aspirated by the Levin-Wangensteen suction and lost via sweating and fistulae
   a) 1st liter—5% Dextrose in water plus 500 mg Terramycin
   b) 2nd liter—5% Dextrose in Physiological Saline plus Vitamins
      1) B-1 ampoule Solu-B
      2) C-500 mg
      3) K-30 mg Synkavite I M , K_1 (Mephyton-Merck or Konakion-Roche) I V
   c) 3rd liter—5% Dextrose in water plus 3 Gms KCl (40 mEq /L)
7. Rectal Tube—q i d for ½ hr and P R N
8. Record fluid intake and output chart and graph
9. Oxygen—6 to 10 liters per minute, depending upon patient's general condition and cardiac status

B MEDICATION

1. Demerol—100 mg Dilaudid gr 1/32 or Morphine Sulphate gr 1/6 for pain q 4 hrs P R N
   a) **Do not give narcotic drugs until patient is fully awake'**
2. Combiotic—1 ampoule (full strength) I M stat—and daily for 6 days (on order of Surgeon)

3 Thorazine Compazine, Dramamine, Bonamine for post-nausea and post vomiting q 4 hrs P R N
4 Phenobarbital gr 1 q P M (h s), may repeat 1x during night
5 Transfusions, plasma and human albumin (salt free) P R N for blood loss, surgical shock, anemia or hypoproteinemia (On order of Surgeon)

C SUBSEQUENT POSTOPERATIVE PROCEDURE

1ST TO 3RD P O DAY

A MANAGEMENT

1 Parenteral Fluids
 a) Begin supplemental oral fluids,
 b) Continue to supplement fluids orally until adequate fluids can be taken by mouth (usually within 6-8 days)
 c) Parenteral fluids may be discontinued if oral fluid intake is sufficient and urinary output is at least 1000 cc daily
2 See Postoperative G I Diet—"Oral Fluids", and "Soft Diet
3 Return-flow enema may be employed

B MEDICATION

1 Codeine and barbiturates should replace routine use of Demerol, Morphine and other narcotics after the 3rd P O day

4th P O DAY—(Same as 3rd P O Day—Add)

A MANAGEMENT

1 Qt S S Enema on 4th day if no B M since operation
2 See Post-operative G I Diet

B MEDICATION

1 Mineral Oil—1 oz q P M

5th P O DAY SAME AS 4th P O DAY—ADD

A MEDICATION—Continued orally for patient's entire hospital stay

1 Ferrous sulphate—gr 1 t i d p c , or (Feosol, Hematinic plastules Lextron, Liafon, Perihemin etc)
2 Multi vitamin capsules, (Therapeutic dosage)
3 Cevitamic acid, 100 mg t i d

6TH P O DAY—SAME AS 5TH P O DAY—ADD

A MANAGEMENT

1 6th P O Day—G I Diet as scheduled
2 Enema (S S) 2 qts q 2 days P R N

7TH P O DAY—SAME AS 6TH P O DAY—ADD

A MANAGEMENT

1 8th P O Day Regular G I Diet as scheduled
2 Fluids orally as patient desires

D REMAINDER OF PATIENTS STAY IN HOSPITAL

1 Follow G I Diet as scheduled alter to patient's need P R N

2 Order complete blood count once weekly until hemoglobin of 90% is attained
3 Order blood cevitamic acid once weekly if normal level of 0 7 to 1 4 mg /100 cc is not attained
4 Before discharging patient
   a) Order complete gastric analysis (See Gastric Studies)
   b) X-rays—Upper G-I Tract Study, (on Surgeon's order)
5 Day of patient's discharge
   a) Have dietician explain P O Diet
   b) Give patient a typed diet sheet if possible
   c) Weigh patient regularly

NOTES

3 Thorazine, Compazine, Dramamine, Bonamine for post nausea and post-vomiting q 4 hrs P R N
4 Phenobarbital gr 1 q P M (h s), may repeat 1x during night
5 Transfusions, plasma and human albumin (salt free) P R N for blood loss, surgical shock, anemia or hypoproteinemia (On order of Surgeon)

C SUBSEQUENT POSTOPERATIVE PROCEDURE

1ST TO 3RD P O DAY

A MANAGEMENT

1 Parenteral Fluids
 a) Begin supplemental oral fluids,
 b) Continue to supplement fluids orally until adequate fluids can be taken by mouth (usually within 6-8 days)
 c) Parenteral fluids may be discontinued if oral fluid intake is sufficient and urinary output is at least 1000 cc daily
2 See Postoperative G I Diet— Oral Fluids ', and ' Soft Diet
3 Return-flow enema may be employed

B MEDICATION

1 Codeine and barbiturates should replace routine use of Demerol, Morphine and other narcotics after the 3rd P O day

4th P O DAY—(Same as 3rd P O Day—Add)

A MANAGEMENT

1 Qt S S Enema on 4th day if no B M since operation
2 See Post-operative G I Diet

B MEDICATION

1 Mineral Oil—1 oz q P M

5th P O DAY SAME AS 4th P O DAY—ADD

A MEDICATION—Continued orally for patient's entire hospital stay

1 Ferrous sulphate—gr 1 t i d p c , or (Feosol, Hematinic plastules, Lextron, Liafon, Perihemin etc)
2 Multi-vitamin capsules, (Therapeutic dosage)
3 Cevitamic acid, 100 mg t i d

6TH P O DAY—SAME AS 5TH P O DAY—ADD

A MANAGEMENT

1 6th P O Day—G I Diet as scheduled
2 Enema (S S) 2 qts q 2 days P R N

7TH P O DAY—SAME AS 6TH P O DAY—ADD

A MANAGEMENT

1 8th P O Day Regular G I Diet as scheduled
2 Fluids orally as patient desires

D REMAINDER OF PATIENTS STAY IN HOSPITAL

1 Follow G I Diet as scheduled, alter to patient s need P R.N

II GENERAL INSTRUCTIONS

A The food actually eaten by the patient at each feeding must be recorded by the nurse on special sheets provided for that purpose

B If the patient experiences any difficulty in taking the diet as outlined, notify dietician

C The fluid intake must be maintained at about 3000 cc daily, plus whatever measured amount is aspirated from the Wangensteen suction

D Vitamin concentrates are started on the 5th P O Day

E Iron therapy is started on 10th P O Day

F When patient goes home he takes with him his diet list and instructions

NOTES

POSTOPERATIVE GASTRO-INTESTINAL DIET

FOR GASTRIC RESECTION, GASTRO-ENTEROSTOMY AND INTESTINAL AND COLON ANASTOMOSIS

I POSTOPERATIVE PLAN FOR FEEDING, (7AM to 10PM)

Operative Day

1st P O Day—Nothing by mouth } I V FLUIDS
2nd P O Day—Nothing by mouth }

3rd P O Day—Don't start oral feedings in gastric cases until Pyloric Balance Test shows a Negative Balance In **intestinal and colon cases feedings are started only after patient has "passed gas from below"**

4th P O Day—**Surgical Liquids**—i e , broth weak tea, weak coffee strained fruit juices, jello, **2 oz q 2 hrs** A minimum of 2 liters I V fluids to supplement oral feedings

5th P O Day—If patient tolerates above feedings, Surgical Liquids' are increased to **4 oz q 2 hrs** and 'water ad lib' A *minimum of 1 liter of I V fluids* may supplement oral feedings Protein supplements (i e) Meritene, Protonal Nutramigen and egg whites are added to the liquid feedings

6th P O Day—**4 feedings** are now instituted Feedings include custard Junket, Jello, chocolate pudding, cereals (cooked) soft-boiled eggs and bread pudding Milk cream protein supplements, vitamins sucrose and dextrose are added to feedings Pureed vegetables are included as well as creamed soups

7th P O Day—4 feedings are maintained for 14 days or longer **Ground beef** may be added to the above Cooked vegetables, i e , mashed potatoes carrots and peas may be added Baked macaroni, noodles, thicker cereals (cooked), cottage cheese (buttered) soft toast, and canned fruits are also added to the menu These fruits include diced fruit salad canned peaches pears and apricots

8th P O Day—to the 14th P O Day—
3 meals daily may be instituted

May add Chopped beef lamb chops steak chicken, turkey and liver Any fruit or vegetable provided it is cooked baked broiled pressure-cooked or canned Fats i e butter cream and olive oil may be increased ad lib Multi-Vitamins A B C and D Vitamin B 12 Folic Acid and Ventriculin should remain in the dietary program

ORDERS FOR GASTROSTOMY

Esophageal obstructions are often of a malignant nature and occur most frequently in the older age group Patients requiring gastrostomy procedures abhor the thought of tubal feedings and so procrastinate until they come to surgery late and in poor condition Prolonged esophageal obstruction causes these patients to become progressively weakened by starvation and dehydration, secondary anemia and avitaminosis ultimately set in and render them unsuitable for surgery It is imperative that the pre- and postoperative measures aim at correcting these deficiencies *

I PREOPERATIVE PROCEDURE

A WORKUP

1 Complete blood count
2 Urinalysis
3 Wassermann or Kahn
4 Total blood protein
5 A/G Ratio
6 NO STOMACH ANALYSIS!
   a) Avoid tubal trauma to esophageal wall
7 Type and cross-match patient, (have donors available), order 2 pints of blood in bank
8 Blood Chemistry
   a) Blood Sodium
   b) Blood Chloride
   c) Blood Potassium
   d) N P N and Urea

B MEDICATION

1 Antiseptic mouth washes
2 Night medication (avoid oral route)
3 Cevitamic acid 1000 mg I V
4 Vitamin B Complex (Solu-B, Upjohn)
   a) Thiamin chloride
   b) Nicotinic acid
   c) Riboflavin
5 Transfusions (repeated if necessary)
6 Parenteral fluids
   a) 2000 cc 5% glucose, 5% amino acids in distilled water, I V
   b) 1000 cc Physiological Saline Solution I V , plus added vitamins add any needed electrolyte
7 Morphine sulphate—gr 1/6 / Scopolamine—gr 1/150 } 1 hr before surgery
8 Antibiotics—on surgeon s order

*Glassman J A., Considerations in the Pre and Postoperative Period of Patients Requiring Gastrostomies —Jour Int. Coll of Surg. Nov Dec., Vol II 1948

PROGRESSION OF POSTOPERATIVE ORAL FEEDING

I **Surgical Liquid Diet** (2-4 oz q 2 hrs)
- Consomme, broth
- Ginger ale, coca cola
- Tea coffee (weak)

II **Semisolid Diet** (2 4 oz q 2 hrs)
- Add
- Cooked cereal
- Buttered toast
- Baked potato
- Soft cooked or poached egg
- Milk, cream
- Custard, ice cream, jello

III **Surgical Soft Diet** (4 feedings/daily)
- Add
- Cooked fruit, without skins
- Cereal, except whole wheat or bran
- Eggs, poached, soft cooked omelet (baked)
- Potato, any form except fried
- Bread, white (plain or toasted)
- Vegetables pureed (carrots peas lima beans, squash, beets, spinach cauliflower)
- Prepared foods (macaroni, spaghetti, polished rice hominy grits)
- Desserts (jello, custards, simple puddings, ice cream, sherbets)

IV **Low Residue Solid Diet** (4 feedings/daily)
- Same as surgical soft diet with the addition of
- Meat (chicken, fish, lamb roast beef, sweetbreads)

Avoid
- All coarse cereals vegetables, bread, and fruits
- Raw fruits and vegetables
- Port, veal, preserved fish and meats
- *Fried or fatty food*
- Spices

V **Regular Diet** (3 or 4 feedings/daily)
- All foods usually taken by the patient

2 Protect the skin about the gastrostomy opening with aluminum or gold paint or paste This paint is mixed with banana oil, and is the same paint ordinarily used on metal radiators
   a) Painting the skin prevents the gastric juice secreted by the gastric mucosa of the tube from digesting the skin about the gastrostomy stoma

NOTES

C MANAGEMENT
1 S S enema 2 qt —night before surgery
2 Nothing by mouth
3 PREP abdomino-perineal, (nipples to mid thighs)
4 On call to O R 15 minutes before scheduled surgery

II POSTOPERATIVE PROCEDURE

A MANAGEMENT

1 **Tube Feeding for Gastrostomy**

a) Recipe*

1000 cc (1 qt) Homogenized milk
500 cc (1 pt) cream (sweet)
4 eggs (raw)
300 cc orange juice (1¼ cupfuls) This may be replaced by artificial vitamin C if fluid volume must be reduced
Cevitamic acid (4 crushed 100 mgs tablets)
75 Gms sugar (5 tablespoonfuls)
5 Gms salt (1 teaspoonful)
2 oz Liver Extract (4 tablespoonfuls)
Cod Liver Oil (or Halibut Liver Oil) 10 minims

b) Directions

1) Mix milk and cream and solids together
2) Add well beaten eggs
3) Add orange juice gradually
4) Finally add Vitamins, Liver Extract and Salt

c) Keep mixture in ice box Give feedings at room temperature in amounts of 4 16 oz at 1 to 3 hr intervals, depending upon the size of the stomach and the patient's tolerance Insert the lubricated catheter into the stomach through the gastrostomy stoma and attach the barrel of a 50 cc glass syringe Fill the barrel of the syringe with the recipe and allow to run into stomach by gravity, (do not squirt feeding into stomach)! Pinch or clamp catheter before withdrawing to prevent leakage of the feeding over abdomen Preferably start feedings with a small catheter (No 14F) and increase gradually to a larger size (No 24F) **

*This recipe may be increased 2 to 4 times depending on the individual daily requirement.

**1) A New Aseptic Double Valved Tubogastrostomy —S-G and O Vol 68 789 791 April 1939
2) Some Modifications on the Aseptic Double Valved Tubogastrostomy"—S-G and O, Vol 74 843 845 April 1942
3) "Considerations on the Pre and Postoperative Management of Patients Requiring Gastrostomy Jour of Int Coll of Surg Nov Dec Vol XI No 6 1948

OPERATIONS PERFORMED IN CASES WITH INCOMPLETE OBSTRUCTION

1 Primary bowel anastomosis
  a) Anterior resection
  b) Left or Right Hemi-colectomy
2 Obstructive-type resection
  a) Abdomino perineal resection
  b) Mikulicz or Lahey resection
3 Transverse Colostomy
4 Ileostomy

I PREOPERATIVE PROCEDURE

A WORKUP

1 Complete blood count
2 Complete urinalysis
3 Wassermann or Kahn
4 **BLOOD CHEMISTRY**
  a) A/G Ratio
  b) Prothrombin Time
  c) **Liver Function Tests**
    1) Cephalin Flocculation Test
    2) Thymol Turbidity Test
    3) Bromsulphalein Test
    4) Alkaline phosphatase
  d) **Renal function tests**
    1) N P N
    2) Urea and uric acid
    3) Creatinine
5 Type and cross match, hold 2 pints of whole blood in bank, or obtain 2 compatible donors
6 Stool to laboratory for blood pus, mucus parasites, cells etc
7 X Rays studies and proctoscopic examination as requested by Surgeon
8 Weigh patient daily and record

B MEDICATION

1 Succinylsulfathiazole, (Sulfasuxadine)
  a) 0 25 Gm per kgm body wt per 24 hrs
  b) The above amount is given as one dose stat, then 1/6 of that amount is given q 4 hrs for 5 days before surgery
  c) In instances where the patient cannot tolerate such a large initial dose the drug may be administered more gradually, i e 3 Gms q 4 hrs for 7-14 days preoperatively
2 Sulfathaladine—may be used in place of Sulfasuxadine
  a) Dose, 1/2 that of Sulfasuxadine
  b) Poth believes Sulfathaladine is antagonistic to Penicillin

ORDERS FOR LARGE BOWEL CASES
(NON-OBSTRUCTIVE OR INCOMPLETE OBSTRUCTION)

The management of bowel obstruction is determined by many factors age, nature of obstruction, extent and location of lesion, and general condition of patient are most important The principles of preoperative care concern themselves with

1 Thorough mechanical cleansing of the bowel
2 Fortification of the liver with respect to glycogen storage
3 Correction of dehydration, anemia vitamin deficiencies and lowered body protein, (hypoproteinemia)
4 General restorative measures
5 The use of Levin-Wangensteen suction when indicated
6 FLUOROSCOPIC EXAMINATION THE DAY BEFORE SURGERY OF ALL BOWEL (AND GASTRIC CASES) TO ELIMINATE THE POSSIBILITY OF RETAINED BARIUM THAT MAY INTERFERE WITH PROPOSED SURGERY

NOTES

5 Have Levin Wangensteen Suction ready at bedside
6 On call to O R 15 minutes before scheduled surgery

NOTES

He also advises increased intake of Vitamin K

3 Streptomycin—is combined with Sulfasuxadine to reduce the bacterial count in the colon where speed in preparing patient is necessary
   a) Dose 1 gm (orally) for 3 doses
4 Bacitracin and Neomycin are commonly employed in place of Streptomycin and Sulfasuxadine
5 Neomycin—1 Gm t i d—may also be effectively combined with Streptomycin
6 Cevitamic acid—1000 mgs daily (orally)
7 Multi-vitamin capsules—1 t i d
8 Fluids—3000 cc daily
9 Blood Transfusions—(on order of Surgeon)
10 Mineral oil—1 oz. q nightly
11 Penicillin 400 000 U daily (on order of Surgeon)
   a) Administered to patients in whom an infection exists—or is suspected
   b) Administered to patients who have an indwelling catheter placed in their bladder prior to surgery
12 Nembutal gr 1½ (orallv) or Phenobarbital gr 1 (hypo) at bedtime
13 Call Anesthesia Department for A M preoperative medication
   a) Demerol 75-100 mg, Scopolamine gr 1/150 } 1 hr before surgery

   or

   b) Demerol 75-100 mg, Phenergan 25 mg } 1 hr before surgery

C MANAGEMENT

1 Hi-carbohydrate non-residue diet if patient can tolerate oral feedings
   a) Surgical Liquids' or Nourishing Liquids (In case of large bowel obstructions only)
2 Dextri maltose sweetened fluids and strained fruit juices, 4 oz q 2 hrs is acceptable I V Fluids used as supplement if necessary
3 Saline Enemas
   a) S S Enema once daily for 3 hrs on the day before
   b) If the lesion can be vis bowel may be clean catheter inserted be
   c) For resections of Physiological S
4 Prep Abdomino-

5 Have Levin Wangensteen Suction ready at bedside
6 On call to O R 15 minutes before scheduled surgery

NOTES

He also advises increased intake of Vitamin K

3 Streptomycin—is combined with Sulfasuxadine to reduce the bacterial count in the colon where speed in preparing patient is necessary
   a) Dose 1 gm (orally) for 3 doses
4 Bacitracin and Neomycin are commonly employed in place of Streptomycin and Sulfasuxadine
5 Neomycin—1 Gm t i d—may also be effectively combined with Streptomycin
6 Cevitamic acid—1000 mgs daily (orally)
7 Multi-vitamin capsules—1 t i d
8 Fluids—3000 cc daily
9 Blood Transfusions—(on order of Surgeon)
10 Mineral oil—1 oz. q nightly
11 Penicillin 400 000 U daily, (on order of Surgeon)
   a) Administered to patients in whom an infection exists—or is suspected
   b) Administered to patients who have an indwelling catheter placed in their bladder prior to surgery
12 Nembutal gr 1½ (orally), or Phenobarbital gr 1 (hypo) at bedtime
13 Call Anesthesia Department for A M preoperative medication
   a) Demerol 75-100 mg, Scopolamine gr 1/150 } 1 hr before surgery

   or

   b) Demerol 75-100 mg, Phenergan 25 mg } 1 hr before surgery

C MANAGEMENT

1 Hi-carbohydrate non residue diet if patient can tolerate oral feedings
   a) 'Surgical Liquids or Nourishing Liquids"
      (In case of large bowel obstructions only)
2 Dextri-maltose sweetened fluids and strained fruit juices, 4 oz *q 2 hrs is acceptable I V Fluids used as supplement if necessary*
3 Saline Enemas
   a) S S Enema once daily for 3 days before surgery and every 3 hrs on the day before surgery until returns are clear
   b) If the lesion can be visualized through a proctoscope, the bowel may be cleansed further by irrigating through a catheter inserted beyond the lesion
   c) For resections of the rectum irrigate distal loop daily using Physiological Saline Solution with rectal tube in place
4 Prep Abdomino perineal (from nipples to mid thighs)

2 Nothing by mouth, except as outlined under "Mineral Oil and Enema Routine"
3 Decompress bowel from above and below
   a) Wangensteen continuous suction with indwelling rubber* Levin tube (16 or 18 F)
   b) Rectal enemas, (Warm saline)
4 MINERAL OIL AND ENEMA ROUTINE
   (Alternating every 2 hours)
   a) **Record Time** Start Levin-Wangensteen suction, give 2 qt warm saline enema stat Do not use vaseline on enema tip
   b) **2 hours later,** instill 2 oz Mineral Oil via Levin tube, shut off suction for 1 hour, then restart suction for 3 hours
   c) **2 hours later;** give 2 qt warm saline enema
      1) **Record character of returns,** feces, fecal color, gas, blood, mucus, tissue, pus, parasites, etc Record findings positive or negative
      2) Whenever oil globules are seen on surface of enema returns call the surgeon immediately
   d) **2 hours later,** instill 2 oz mineral oil via Levin tube, shut off suction for 1 hour, then restart suction for 3 hours
   e) **2 hours later,** give 2 qt warm saline enema, etc , etc , etc
      1) A "complete' obstruction becomes "incomplete" when OIL MEETS WATER, the patient then is classified as 'unobstructive" and prepared as an elective-case (See preoperative procedure for non-obstructive colon cases)
   f) **Example Time Schedule**
      8 a m —2 oz Mineral oil
      10 a m —2 qt Enema
      12 noon—2 oz Mineral oil
      2 p m —2 qt Enema
      4 p m —2 oz Mineral Oil
      6 p m —2 qt Enema
      Continue until "oil meets water"—or "emergency surgical intervention' must be decided upon

C **MEDICATION**
   1 Cevitamic acid—1000 mg daily
   2 NO PITRESSIN PROSTIGMIN ETC
   3 Fluids (I V) 3000 cc daily (See Parenteral Fluids)
   4 Blood Transfusion when indicated on order of surgeon
   5 Antiseptic mouth washes q hourly
   6 Night medication (See Laparotomy orders)

*Avoid a plastic Levin tube whenever possible several cases of traumatic perforation of stomach are now on record

ORDERS FOR LARGE BOWEL CASES
(OBSTRUCTIVE)

The patient entering the hospital is classified by us as OBSTRUCTIVE or NON-OBSTRUCTIVE, (incomplete obstruction) No emergency exists where an incomplete obstruction is present The patient can be prepared as carefully as an elective case An emergency exists when the patient is completely obstructed, however, while the patient is being prepared for the eventuality of emergency surgery, we should make every effort to relieve the obstruction, while at the same time attempt to improve the nutritional status of the patient When we succeed—we obviate the need of an emergency procedure on a poorly prepared patient, as well as avoid the necessity of multiple stage procedures We employ our MINERAL OIL-ENEMA ROUTINE to help us accomplish this end (See Intestinal Obstruction)

GENERAL RULES

1 Drugs that increase the activity of bowel contractions are contraindicated
2 Immediate operation is indicated in strangulating obstructions or when marked distention occurs in complete colonic obstruction

OPERATIONS EMPLOYED IN OBSTRUCTED CASES

1 COLOSTOMY (Transverse type usually)
2 CECOSTOMY (McNealy)
3 MIKULICZ OR LAHEY EXTERIORIZATION PROCEDURE
4 ENTEROSTOMY—*RARELY INDICATED*

I PREOPERATIVE PROCEDURE

A WORKUP

1 Complete blood count, (q 4 hrs on order of surgeon)
2 Complete urinalysis
3 **Type and cross match,** have 4 pints of whole blood in bank, or have two compatible donors available at time of surgery
4 **Blood Chemistry**—(When time and facilities permit)
   a) A/G Ratio
   b) Prothrombin Time
   c) Liver function tests, (Thymol Turbidity or Bromsulphalein)
   d) Renal function tests, (N P N and blood urea)
5 Stool to laboratory for blood mucus parasites, cells, etc
   a) Specimen from 1st saline enema should be used
6 **X-Rays,** flat film of abdomen, (Lying down and upright)
   a) Check large and small bowel gas patterns
7 Thin barium enema or Umbrathor for localization of lesion, (on order of surgeon)

B MANAGEMENT

1 Treat shock initially whenever present (See Shock Management)

INSTRUCTIONS FOR COLOSTOMY PATIENTS

A COLOSTOMY is necessary for some patients At first thought it may seem to be an intolerable condition, but it need not be a nuisance nor as unpleasant as commonly believed With proper care the bowels can be regulated so that there is no unpleasant odor about the patient s body or clothing The bowel movements can be satisfactorily controlled to move at a convenient time The following instructions have been worked out to make the care of the colostomy as easy as possible

Three things are done to control the colostomy

1. The diet is regulated
2. Irrigation or enema of colostomy
3. A regular time is chosen for the irrigation or enema

It is particularly important to realize that where colostomy is present moderate constipation is to be desired and a bowel movement only every second or third day does not necessarily interfere with health The bowels should perferably move only at the time of the irrigation

The following equipment is necessary and should be procured from a drug store Two quart enema can or bag (if desired for travelling), 4 feet of connecting hose with a shut-off glass adapter, and a 22 to 26 French catheter Warm water from the faucet can be used for the irrigation and soapy water can be substituted if an unsatisfactory result is obtained

The enema can or bag with the 2 quarts of warm water can be fastened about 4 feet above the floor, if abdominal cramps are too severe it may be lowered The patient may lie on the side, stand or sit The catheter is lubricated and inserted for a distance of at least 6 inches or full length if it can be done without discomfort At times it will go in with difficulty When this occurs try pushing it in while the water is running The apparatus is connected and the water allowed to flow at a speed consistent with comfort This can be regulated by the height of the can and the shut-off, since too rapid a flow may cause distention of the bowel, and produce distress If the bowel feels quite full, and the fluid has not already begun to flow from the colostomy the catheter should be removed and the fluid and feces will be evacuated A pan or pail is firmly pressed against the abdominal wall below the colostomy and held obliquely so that even with forcible ejection all water and fecal matter is caught If an unsatisfactory fecal result is obtained, the irrigation can be repeated several times with additional water Sufficient time should elapse to allow the return of all fluid

For a short while irrigations may have to be taken every other day either morning or evening The evening seems preferable since a pad of absorbent material can be left over the colostomy at night to catch any retained water Each patient can work out his or her most convenient time During this period the SECOND COLOSTOMY DIET should be followed After awhile irrigations mav be taken every third day and the

7 Demerol—75-100 mg } 1 hr before surgery
Scopolamine—gr 1/150

NOTES

POSTOPERATIVE ORDERS FOR ALL LARGE BOWEL CASES

PLACE PATIENT ON SAME SCHEDULE FOR "POST OPERATIVE ORDERS OF GASTRIC CASES"

A MANAGEMENT

1 Check blood pressure and pulse q 10 minutes until stabilized, then ½ hour 4 times, then q 1 hr 4 times, thereafter q 3 hrs for 24 hours
2 Encourage deep breathing, coughing, leg and foot exercises and side-to-side turning q hourly Ace Elastic Bandages are routinely applied to lower extremities of all patients over 60 yrs of age
3 Nothing by mouth, frequent mouth rinses q hourly
4 Continuous Levin-Wangensteen Suction
 a) Check tubing
 b) Allow sips of water with suction on
 c) Check suction (break connection)
 d) Check connections
 e) Check switch and socket
 f) Check glass tube and rubber
 g) Use 50 cc syringe to check tubal patency
5 Catheterize q 8-10 hrs P R N for distention or/and discomfort
6 Oxygen as necessary via intranasal catheter; 4 8 liters/min
7 Rectal tube q i d for ½ hr , also P R N
8 I V Fluids—3 liters daily, (more fluids on order of Surgeon)
 a) 1st Liter—5% Dextrose in water, plus 500 mg Terramycin
 b) 2nd Liter—5% Dextrose in water plus vitamins
  B—1 amp Solu-B
  C—500 mg
  K—30 mg K_1—Mephyton (Merck) or Konakion (Roche)
 c) 3rd Liter—5% Dextrose in Physiological Saline Solution, add 3 Gms , (40 mEq/L) Potassium Chloride
9 Record fluid intake and output chart and graph
10 Observe wound for signs of redness or drainage

B MEDICATION

1 Demerol—75-100 mg (Hypo) q 4 hrs P R N
 (Do not give until patient is fully awake!)
2 Combiotic—1 ampoule (full strength) I M stat and daily, (Antibiotic at discretion and order of surgeon)
3 Thorazine, Dramamine or Compazine may be employed for post nausea, post vomiting or hiccoughs, (10 to 25 mgs , hypo)
4 Phenobarbital gr 1 (hypo) q P M (h s), may repeat 1x during night
5 Antiseptic mouth wash q hourly

THIRD COLOSTOMY DIET can be added to the second If there is any fecal discharge from the colostomy at other times than following irrigation, 1 teaspoonful of tincture of paregoric can be taken at each discharge If the bowel becomes loose due to other causes, return to the first colostomy diet for a few days No cathartics, laxatives or oil need be employed

One can readily take care of his colostomy unaided when he has gained confidence A colostomy bag with disposable plastic bags is not always necessary The colostomy can be covered with a piece of gauze, cotton, cloth or soft paper which can be held in place by a small elastic belt or adhesive tape Some patients elect to wear a bag until they gain more confidence in their control The irrigations can be modified by the physician, depending upon the circumstances in each case

A considerable number of people find it necessary to adjust themselves to a colostomy During this period of adjustment, one will be encouraged to know that many people continue to carry on responsible jobs and social activities with a minimum of inconvenience

NOTES

a) The day after opening proximal loop, insert a No 14F rubber catheter and instill 3-4 ounces of warm mineral oil as a retention enema if no B M occurs Thereafter, irrigate with Physiological Saline Solution using a catheter so that a B M occurs at least every other day

3 Start feedings and increase daily after colostomy is opened

4 Order dressings changed P R N

5 Start Mineral Oil 1 oz q nightly after colostomy is opened

STEP 2

1 **The clamp on distal loop is removed—on 5th P O day by surgeon**

2 **Management of distal loop of bowel**

a) The day after opening distal loop, insert a No 14F rubber catheter and put a rectal tube in place Irrigate distal loop through catheter from above using syringe or enema can, with 2000 cc of warm Physiological Saline Solution Thereafter irrigate once or twice daily using saline solution on successive days Irrigating solutions may be fortified with Sulfasuxadine or Sulfathalidine Following Step 2, the surgeon may elect to close the double-barrel colostomy in a single procedure or in multiple stages A one-stage colostomy closure is being employed more frequently because it works less hardship on the majority of patients, both physically and economically

STEP 3

1 Spur clamp is applied by the surgeon 10-14 days after operation

2 Order spur clamp tray

3 Arrange dressings to support spur clamp vertically

4 Tighten spur clamp daily

5 Spur clamp falls off on 5th day after application

6 No irrigations given while spur clamp is in place

7 Continue irrigations after spur clamp falls off

8 Patient is allowed to go home after spur is crushed Closure of colostomy is attempted at a later date

STEP 4

THE COLOSTOMY IS CLOSED 6-8 WEEKS AFTER THE SPUR IS CRUSHED THE PATIENT RETURNS TO THE HOSPITAL AND IS PREPARED FOR SURGERY AS FOLLOWS

PREOPERATIVE ORDERS

A) WORKUP
B) MANAGEMENT
C) MEDICATION
} See— Preoperative Orders for Large Bowel Cases—(Non obstructive '

Under medication —add

1 **Oral antibiotics**—for local sterilization of proximal loop

2 **Irrigations**—for distal loop sterilization

C FOLLOW-UP

1 Complete blood count daily
2 Complete urinalysis daily
3 Start feedings after the colostomy is opened, and increase daily
4 Order dressings changed P R N
5 Start mineral oil 1 oz q nightly after colostomy is opened

THE FOLLOWING POSTOPERATIVE ORDERS APPLY TO THE SPECIFIC SURGICAL PROCEDURES IN ADDITION TO THE REGULAR LISTED POSTOPERATIVE ORDERS FOR BOWEL SURGERY

A CECOSTOMY, (McNealy)

1 Cecostomy opened—24-48 hrs later by surgeon
2 The curved forceps are each moved ¼ inch, when possible a silk purse string suture is inserted and a stab wound made in the cecum
3 A No 26 Pezzar catheter or Paul s tube is inserted and held in place by the tensed purse string suture
4 On 2nd or 3rd day P O (as indicated by surgeon), remove curved forceps from cecum
5 Iodoform gauze packing removed from wound by 5th day P O
6 Order colostomy tray set-up
7 Connect catheter in bowel to drainage bottle
8 Start feedings and increase gradually after cecostomy is opened Start daily irrigations with Physiological Saline Solution 24 hrs after opening cecostomy
9 Order dressings changed P R N Do not use petrolatum dressings about the wound

B COLOSTOMY

1 Colostomy opened 24-48 hrs later by surgeon, (may be carried out in patient s room)
2 Order cautery to patient's room or operating room as indicated by surgeon
3 Colostomy is opened with cautery by making an incision into bowel *8 inch forceps are applied to crush the bowel and thus* separate the two ends Forceps fall off in 5-6 days
4 Start feedings and increase gradually after colostomy is opened
5 Start daily irrigations of distal loop 24 hrs after the colostomy is opened, (See— 'Obstructive Colostomy —Step 2 for Management of Proximal Loop)
6 Order Dressings changed P R.N

C OBSTRUCTIVE COLOSTOMY—(OBSTRUCTIVE RESECTIONS, MIKULICZ, RANKIN)

STEP 1

1 *Upper clamp (on proximal loop) removed 1-4 days P O by surgeon*
2 Management of proximal loop of bowel

ORDERS FOR ANAL CONDITIONS
(HEMORRHOIDS, ANAL FISSURES, POLYPS AND FISTULA IN ANO)

I PREOPERATIVE ORDERS

A WORKUP

1 Complete blood count
2 Complete urinalysis
3 Wasserman or Kahn
4 Anoscopic and Sigmoidoscopic*, Routine on all rectal cases
5 X-Ray of colon, Routine in all cases

B MANAGEMENT

1 2 qt S S Enema night before surgery
2 2 qt warm saline enema in the A M of surgery, repeat until returns are clear
3 Light non-residue diet on day before surgery
4 N P O after 6 P M except water, no water after midnight
5 Prep Perineal, from sacrum and buttocks to mid thighs

C MEDICATION

1 No cathartics or laxatives
2 Night medication, (Phenobarbital, Nembutal, Seconal, Miltown etc)
3 Bowel sterilization, (Sulfasuxadine, Bacitracin, Neomycin, Streptomycin or any desired combination Start 2 or more days preoperatively
4 Demerol 75-100 mgs, Scopolamine gr 1/150 } 1 hr before surgery

II POSTOPERATIVE ORDERS

A MANAGEMENT

1 Check blood pressure and pulse q 15 minutes until stabilized, thereafter q 3 hrs
2 Encourage deep breathing leg exercises and side to-side turning q hourly
3 Nourishing liquids as tolerated on 1st day P O,
 2nd day P O Bland Diet
 3rd day P O regular diet
4 Catheterize q 10 hrs P R N for distention or discomfort
5 Vaselinated rectal plug removed by Surgeon after 24 hours
6 Hot sitz baths q i d for 15 30 minutes, start immediately after removal of rectal plug
7 If no B M by the 4th day P O Give 8 oz warm mineral oil retention enema employ 18-24 F catheter, be gentle and observe sterile precautions
8 Application of moist warm compresses to perineum q i d and P R N, Warm sitz baths after each bowel movement

*In our series of operations for carcinoma of the large bowel over 42% had some form of ano-rectal surgery elsewhere for rectal bleeding within the past year

POSTOPERATIVE ORDERS

A) MANAGEMENT
B) MEDICATION
C) FOLLOW-UP LAB

See Postoperative Orders for Large Bowel Cases—(Non-obstructive)

D ABDOMINO-PERINEAL RESECTION (See Pre- and Postoperative Orders listed under ORDERS FOR BOWEL CASES)

1 One Stage Resection

a) The colostomy and resection are carried out in one operation
b) Management of Perineal Wound
   1) Pull out Penrose drains starting on 2nd or 3rd day P O as indicated by surgeon Irrigate if wound drains excessively

2 Two Stage Resection

a) The interval between colostomy and abdomino-perineal resection is usually 10-30 days depending upon when the patient can be brought into optimum condition

NOTES

ORDERS FOR NON-INFECTED BONE, JOINT, TENDON, SKIN GRAFT, AND VASCULAR CASES

I PREOPERATIVE ORDERS

A WORKUP

1 Complete blood count
2 Urinalysis
3 Wassermann or Kahn
4 A/G Ratio
5 **For extensive bone operations**
   a) Type and cross-match patient, hold 2 units of blood in bank
   b) Prothrombin Time
   c) Coagulation Time
6 Oscillometric readings when indicated
7 Skin temperature readings, when indicated
8 X ray studies as required
9 Special intravascular studies as required
   a) Arteriograms
   b) Aortograms

B MEDICATION

1 **CHEMOTHERAPY ON SURGEON'S ORDERS**
   a) ANTIBIOTICS (See Antibiotics)
      1) Penicillin
      2) Streptomycin
      3) Chloromycetin—etc
   b) SULFONAMIDES
      1) Sulfathiazole
      2) Sulfadizaine
      3) Triple sulfas
2 Night medication—Phenobarbital, Seconal Nembutal
3 Demerol 100 mg, Scopolamine gr 1/150 } 1 hr before surgery

C MANAGEMENT

1 **Preparation of operative site (night before surgery)**
   a) Shave operative area (avoid nicking skin)
   b) Wash operative area thoroughly with soap and water
   c) Cleanse under nails and between toes and fingers
   d) Wash with alcohol and bi chloride solution, dry with ether, Phisoderm or merthiolate may also be used
   e) Apply sterile dry dressings
   f) Wrap entire limb in sterile towels patient goes to surgery with sterile wrappings in place
2 2 qt S S Enema night before surgery
3 **Special preoperative considerations**
   a) Obtained desired type of splint and pad it properly

9 Inspection and careful digital examination before patient is discharged

B MEDICATION

1 Demerol 75 mg
Phenergen 25 mg } For pain q 4 hrs p r n
2 Codeine gr 1 and Phenobarbital gr 1 (hypo) for pain q 4 hrs P R N, start after 1st 24 hrs Demerol only if necessary
3 **Mineral Oil**—1 oz q nightly, h s, start 1st P O day
4 **Sulfasuxadine** for 3-5 days postoperatively, on order of Surgeon
5 **Seconal** or Nembutal gr 1½ q P M (h s)

NOTES

ORDERS FOR VAGINAL, CERVICAL AND PERINEAL SURGERY

BY

J P GREENHILL, M D

Professor of Gynecology at the Cook County Post-Graduate School of Medicine Attending Gynecologist at Cook County Hospital Sr Attending Obstetrician and Gynecologist at Michael Reese Hospital Chicago Illinois

I PREOPERATIVE PROCEDURE

A WORK UP

1 Complete blood count, blood type and Rh determination
2 Wassermann or Kahn test
3 X-ray of chest, (routine)
4 Urinalysis complete
5 Routine Electrocardiogram in women past 45 years of age
6 In special cases fasting blood sugar, blood urea nitrogen and creatinine
7 If there is urinary tract disease catheterize for microscopic examination, culture and sensitivity studies In indicated cases, cystoscopy or intravenous pyelogram must be carried out
8 Check-up by internist for possible diseases of the heart, lungs, vascular system kidneys thyroid pancreas, etc Especially in elderly women
9 Consultation with specialist when necessary
10 Soft diet day before operation
11 Prepare mental attitude, (psychotherapy)

B MANAGEMENT

1 Shave vulva, perineum perianal area, mons veneris and abdomen
2 Cleansing douche, (patient lies in bath tub)
3 S S enema 2 qt
4 Nothing by mouth for 8 hours before surgery
5 Immediately after medication (see below) insert Penicillin suppository high up in the vagina If patient is sensitive to Penicillin, insert a Furacin or Westhiazol vaginal suppository instead

C MEDICATION

1 Seconal gr 1½ or Nembutal gr 1½ by mouth at 9 30 P M night before surgery Repeat after 3 hrs if necessary
2 Demerol 50 to 100 mgs (depending on patient s weight and Scopolamine gr 1/150
3 On call to operating room 30 minutes before scheduled surgery

D MANAGEMENT IN OPERATING ROOM

1 Prepare vulvar area anal region and lower abdomen with

b) Have all X-rays in operating room
c) Check with Surgeon and O R on any special setup, instruments, or materials that may be required
d) In vascular grafting be sure to arrange in advance with the Blood Vessel Bank for any desired arterial graft, homograft or synthetic prosthesis
e) Have pre- and postoperative photographs on all patients of unusual interest
f) Have all skin grafting instruments available Blair knife, suction Padgett Dermatome, or Electric Dermatome

NOTES

a) Morphine sulphate gr 1/4 or Demerol 50 to 100 mgs for pain or restlessness q 4 hrs p r n

2 After 24 hrs

a) Antibiotics—only if indicated, ordered by surgeon

b) Analgesics—(hypo) if absolutely necessary

c) Codeine sulphate gr 1/2 and aspirin gr x for pain q 4 hrs p r n

C FOLLOW-UP LAB

1 Complete blood count on 4th p o day

NOTES

soap and water followed by an antiseptic
2 Catheterize Leave indwelling or Foley catheter in indicated cases
3 Wash vagina with soap and water Dry and apply antiseptic solution
4 If anterior colporrhaphy is performed insert a Foley retention catheter in the bladder
5 If a plastic operation is done, insert a gauze pack snugly into the vagina

II **POSTOPERATIVE PROCEDURE**

A **MANAGEMENT**

1 Check B P and Pulse q 15 minutes until patient is fully awake, then q 4 hrs for 1st day Thereafter B P pulse and temperature every morning for 4 days
2 **COMPLETE THE I V FLUIDS** started in operating room
3 **CONTINUE I V FLUIDS**—with (2) additional liters
 a) 1000 ml 5% Dextrose in water
 b) 1000 ml 5% Dextrose in Physiological Saline Solution
 c) May add Vitamins B and C if necessary
4 **BLOOD TRANSFUSION** if blood loss warrants it
5 **SURGICAL LIQUIDS**—orally if nausea and vomiting cease
 a) 1 oz q hourly—in teaspoonful amounts
6 If a Foley catheter was inserted—connect it to the bottle under bed Keep intake and output chart
7 **ENCOURAGE DEEP BREATHING** and frequent movement from side to side
8 **FULL DIET** Special diets for patients with diabetes or other illnesses
9 If gauze pack was inserted in the vagina—remove it
10 If patient cannot urinate spontaneously catheterize anytime after 4 hours for distress or every 8 hours P R N if no distress, or insert a retention catheter for 48 hours If retention catheter is used give Gantrisin 1 Gm q i d for 7 days
11 Remove catheter on 5th day, if residual urine is more than 100 cc continue to catheterize for residual urine at least once daily
12 **Rectal tube** P R N for ½ hour
13 ENEMA (warm saline) on 4th P O day if no spontaneous bowel movement occurs milk of magnesia ½ oz in A M and P M may be used
14 **HOT SITZ BATHS**—b i d and p r n for pain in the vagina, perineum or rectal area beginning on 3rd P O day

B **MEDICATION**

1 **On 1st day**

a) Morphine sulphate gr $\frac{1}{4}$ or Demerol 50 to 100 mgs for pain or restlessness q 4 hrs p r n

2 After 24 hrs

a) Antibiotics—only if indicated, ordered by surgeon

b) Analgesics—(hypo) if absolutely necessary

c) Codeine sulphate gr $\frac{1}{2}$ and aspirin gr x for pain q 4 hrs p r n

C FOLLOW-UP LAB

1 Complete blood count on 4th p o day

NOTES

ORDERS FOR THYROIDECTOMY

INDICATIONS for thyroid surgery are found in the various types of thyroid diseases Non toxic diffuse (colloid) goiters are removed surgically when they produce dyspnea, dysphagia or are too unsightly because of their size Toxic diffuse goitre (Exopthalmic Goitre Grave's Disease—Basedow s Disease) can be successfully treated with radioactive iodine (I^{131}) in many instances, surgical extirpation is reserved for medical failures or complications resulting therefrom Thyroidectomy is the procedure of choice for thyrotoxicosis in pregnancy Toxic and Non toxic Nodular Goitres should be treated by surgical excision Carcinomas of the thyroid gland have failed to respond to radio active therapy, therefore we must resort to total thyroidectomy, with or without radical neck dissection for all carcinomas of the thyroid gland **RADIOACTIVE IODINE (I^{131}) IS THE PREFERRED TREATMENT OF UNCOMPLICATED TOXIC DIFFUSE GOITRE, (EXOPHTHALMIC GOITRE)**

In the past 15 years thousands of cases of hyperthyroidism have been treated with I^{131} with a high degree of success Results with I^{131} have been in many instances as good as with surgery and superior to all other anti thyroid drug therapies

ADVANTAGES OF I^{131} TREATMENT

1 No surgery involved
2 No postoperative discomfort
3 No anesthesia, No scar
4 Economically superior, (outpatient follow-up treatment)

DISADVANTAGES OF I^{131} TREATMENT

1 Latent period of 2 or more months required before favorable results become manifest
2 Difficulties and errors in determining dosages
   a) **Single dose**—overdosage may lead to myxedema
   b) **Multiple dose**—requires longer time for results
3 Carcinogenic properties feared
   a) Experimental evidence suggests carcinogenic possibility no single human case as yet reported
4 Pregnancy with hyperthyroidism fear of cretinism in fetus
5 Treatment of severe toxic goitre may precipitate a Thyroid Crisis
6 Ineffective in thyroid carcinomas, only slightly effective in toxic nodular goitres

Ideal indications for treatment with radio active iodine (I^{131}) are as follows

1 Patients with previous unsuccessful thyroidectomy
2 Severe thyro-cardiacs
3 Poor risk patients who have failed to respond ideally to anti thyroid drugs

4 Patients who fear and refuse surgery
5 Older age groups, (over 70 years)

The most important factors to be considered in hyperthyroidism are the degree of toxicity, the presence or absence of auricular fibrillation, upper respiratory infection, hypertension and the degree of elevation of the P B I and the metabolic rate The optimum time to operate is when the patient's muscular strength and weight are increasing and the pulse rate, pulse pressure, B M R , and emotional instability are decreasing

I PREOPERATIVE ORDERS

A WORKUP

1 Blood count (complete)
2 Urinalysis (complete)
3 Wassermann or Kahn
4 Record and chart B P , pulse and respiration daily, also pulse pressure
5 Evaluate and record
   a) Muscular power (Quadriceps)
   b) Emotional status, (restlessness, tremor, crying, speech, etc)
6 X-Ray of Neck and Chest (A-P and Lateral Views)
   a) Check for tracheal deviation
   b) Check for substernal and thoracic goiters
7 B M R and Protein Bound Iodine studies *
8 Radioactive Iodine, (I^{131}), Uptake and Tracer Studies *
9 Examine vocal cords, (Otolaryngologist)

*THYROID FUNCTION TESTS

A RADIO ACTIVE IODINE UPTAKE STUDY (I^{131})—

1 This test is a measure of thyroid gland avidity for iodine The uptake of I^{131} depends directly on thyroid gland avidity for iodine—and inversely on the discharge of newly formed thyroid hormone

Normal—(Euthyroid)		15-15% uptake of ingested dose
Hypothyroidism		10% less
Hyperthyroidism	(Moderate)	50% and over
	(Severe)	75% and over

2 **In Severe Hyperthyroidism**—rate of thyroid hormone production exceeds the rate of iodine trapping 6-8 hours after I^{131} ingestion **The uptake at 8 hrs may exceed the uptake at 24 hrs**

A VARIATION IN TECHNIC FOR MEASURING I^{131} UPTAKE

a) **Measure of I^{131} Uptake**
   After 3-6-8-24 and 48 hrs
b) **Measure of Urinary Excretion of I^{131}**
   After 24 and 48 hrs

c) **Measure** (quantitive of I^{131} combined with newly formed serum protein bound I^{131}

B) **SERUM PROTEIN BOUND IODINE**

1 This is a chemical determination of serum protein bound iodine—or the amount of thyroid hormone attached to serum protein

2 **Butanol—extractable iodine**—is a more accurate measure or **assay of functioning thyroid hormone** Where an excess of inorganic iodine has been ingested—protein bound iodine is inaccurate, (i e) the readings remain excessively high for many months The butanol-extraction method is more re liable in these cases because it measures only the thyroid hormone

C) **BASAL METABOLISM**

1 This is a measure of hypermetabolism and thyroid hormone influence on body metabolism

2 **Advantages** of B M R are

a) Availability and low cost

b) B M R measures thyroid function regardless of inorganic iodine intake

3 **Disadvantages** of Basal Metabolism are

a) Difficulty of attaining physical and mental relaxation

b) About 30 40% error (mechanical and technical)

c) Heart disease hypertension pheochromocytomas fevers and malignancies may influence the metabolism of the body

B **MANAGEMENT**

1 High carbohydrate diet sweeten drinks with Dexin or Sucrose recommend hard sugar candies

2 **KEEP PATIENT QUIET AT ALL TIMES**

a) Darken room

b) Plug ears with cotton

c) Cover eyes with folded towel

d) Have a sign on door

THYROID PATIENT QUIET'

3 (2 qt) S S enema night before surgery

4 PREP neck and chest, from above chin to nipples

5 Nothing by mouth, except water after 6 00 P M no water after midnight

6 Check vocal cords before and after surgery, (Laryngologist)

a) Demonstrate normal vocal cords if possible Preexisting

paralysis can be attributed to surgery if not recognized in the preoperative period[1]

C MEDICATION

1 Thiourea drugs
  a) Thiouracil—100 mg t i d or q i d
  b) Propylthiouracil—50 mg q i d to as high as 100 mg q i d (Check blood count periodically)

2 Lugol s Solution*—10 15 minims t i d

3 Nembutal gr 1½ at 10 00 P M , (h s)

4 See Thyroid Premedication

5 Equanil—400 mg t i d , on order of surgeon

6 Demerol—100 mg / Scopolamine—1/150 gr } 1 hr before surgery

II IN OPERATING ROOM

1 Intubation preferred in all cases

2 I V 5% Dextrose in water

III POSTOPERATIVE ORDERS**

A MANAGEMENT

1 Check blood pressure and pulse q 10 minutes until stabilized, then q 30 minutes 4 times then q 1 hour 4 times, then q 3 hours for first 24 hours

2 Darken room and keep patient absolutely quiet

3 After patient awakens from anesthesia elevate head of bed

4 Cracked ice for thirst

5 Liquid diet—2-4 oz q 2 hrs

6 **I V FLUIDS—3 liters for 24 hours**
  1st liter—5% Dextrose in water plus 500 mg antibiotic on order of surgeon
  2nd liter—5% Dextrose in Physiological Saline Solution, add Vitamins 1 amp Solu-B 500 mg Vitamin C, 30 mg Synkavite or Vitamin K_1 (Mephyton)
  3rd liter—5% Dextrose in water

7 Steam vaporizer—employing Compound Tincture Benzoin if tracheal irritation exists, on order of surgeon

8 Call surgical Resident immediately if patient develops
  a) Dyspnea
  b) Rapid Pulse
  c) Air hunger or
  d) Cyanosis

B MEDICATION

1 Demerol 75-100 mg for rapid pulse restlessness or pain q 4 hrs P R N

*Omit if goitre is non toxic In cases of thyrotoxicosis initially prepared with thiourea drugs we administer supplemental Lugol s Solution for about 7 days prior to surgery

**NOTE ROUTINELY
Keep tracheotomy and Intubation set up in room for 1st 24 hrs

a) Do not give until patient is fully awake!

2 Antibiotics—on order of surgeon

3 Sodium Phenobarbital gr 2 t i d (hypo) and P R N

C IF IMPENDING CRISIS IS SUSPECTED OR DEVELOPS

1 Morphine sulphate gr 1/6, repeat until sleep occurs or respirations are reduced to as low as 15 per minute

2 Oxygen—(Intranasal catheter preferably), 8-12 liters per minute

3 I V 5% Glucose in water

a) 3-4 liters in 24 hours

4 For hyperpyrexia

a) Ice packs to head and precordium

b) Alcohol sponge baths

c) Proctoclysis, (cold water)

5 Digitalization may be indicated in borderline thyrocardiacs

NOTES

ORDERS FOR SPLENECTOMY

Patients who require splenectomy are generally poor surgical risks The dangers of splenectomy have been decidedly reduced since the introduction of better pre- and postoperative preparation of the patient, the immediate availability of large quantities of blood, new anesthetic drugs and technics, and wide spectrum antibiotics In elective splenectomy, blood volume measurements, red blood cell counts and sternal marrow studies should be done with the hope of establishing a normal blood picture preoperatively In certain emergent incidents, (i e ruptured spleen and acute phase of thrombocytopenic purpura), blood volume losses cannot be completely replaced because of continued bleeding or active blood destruction Where splenectomy cannot be unduly delayed, a cutdown' in one or more veins, employing a large bore polyethylene tube or needle (18-20 gauge), will permit a constant replacement of blood during and after surgery **In some patients where blood destruction or blood loss exceeds blood replacement a splenectomy must be performed despite the presence of imminent shock.**

Fresh blood is superior to stored blood because of its higher platelet content Platelets in stored blood rapidly disintegrate on standing thereby making such blood less desirable when treating a platelet deficiency as occurs in thrombocytopic purpura

SPLENECTOMY

I PREOPERATIVE PROCEDURE

A WORKUP

1 Complete blood count and detailed differential cell study Hematological consultation should be sought
   a) Platelet counts
2 Bone marrow studies, (Sternal puncture)
3 Wassermann or Kahn
4 Bleeding Time (Duke)
5 Coagulation Time (Lee-White)
6 Prothrombin Time (Quick)
7 Coombs Test
8 Reticulocyte Count
9 Serum Bilirubin

(Items 3–9:) See Standard Diagnostic Procedures

10 Heparin-Protamine Titration
   a) An increase of heparin like' substances may be neutralized by administering toluidine blue or protamine sulphate
11 Type and Cross Match
   a) Order 4000 cc (8 units) of whole blood in bank Order compatible donors and have them available if no blood bank exists

B MANAGEMENT

1 Levin Wangensteen Suction, continuous throughout night
2 S S Enema (2 qt) night before surgery
3 Preoperative blood transfusions to improve blood quality
4 Nothing by mouth after 6 00 P M , no water after midnight Prep abdomino-perineal (from nipples to mid thighs)

C MEDICATION

1 Antiseptic mouth washes (Hydrogen peroxide mixed half and half with water) q hourly
2 Nembutal gr 1½ orally, or Phenobarbital gr 2 via (hypo) if Levin-Wangensteen suction is going
3 Check with patient for any drug or antibiotic sensitivity, **if not sensitive,** give Combiotic 1 amp (full strength) (I M) night before surgery, (on order of Surgeon)
4 Demerol—75 to 100 mg } 1 hr before surgery
Scopolamine—gr 1/150 }
5 ACTH Cortisone and cortisone derivatives have proven beneficial in alleviating symptoms resulting from idiopathic forms of hyemolytic anemias and thrombocytopenic purpu ras

II IN OPERATING ROOM

A Administer blood during the surgery at a rate commensurate with the need

B **In congenital hemolytic jaundice the possibility of encountering a severe reaction during a blood transfusion is great, whenever possible, we try not to administer blood until after the splenectomy**

III POSTOPERATIVE ORDERS

A See Laparotomy Postoperative Orders , in addition order

1 Blood transfusions as indicated
a) Have a cut-down (16-18 gauge) needle or polyethylene tubing in place during and after surgery
b) Repeat routine and special blood studies as required
c) Hematological consultations as required and as ordered by Surgeon

BURNS

I GENERAL CONSIDERATIONS

Today the possibility of mass disasters resulting from peacetime accidental atomic explosions and atomic warfare has become a reality—and greater stress must be placed upon the "mass-management' of blast and thermal effects, as well as nuclear irradiation Burns have now become the concern of everyone All available manpower must be mobilized to meet this emergency and must include doctors, nurses, orderlies administrative personnel and non technical groups Emergency auxiliary help will come from Civil Defense and Red Cross organizations The philosophy in dealing with mass burn casualties is not different from that in handling mass war injuries **The objective is to give primacy in treatment to those individuals most likely to survive their trauma** *

II DEFINITION

A burn is a surgical wound, and as such ' bleeds , not blood, but plasma into the wound and surrounding tissues This is the so-called **"white hemorrhage" of Koch The concept that a burn is a wound requiring the same aseptic precautions followed in any surgical wound is not yet fully appreciated** A burn has the following features in common with a surgical wound

1 Skin disruption
2 Hemorrhage (white hemorrhage)
3 Bacterial contamination
4 Shock

III PATHOLOGY OF BURNS

A LOCAL PATHOLOGY OF THERMAL BURNS

The pathological changes incurred by a severe burn may not subside for several days In an electrical burn demarcation of dead from living tissue may require weeks This fact influences the type and duration of burn management The burnt cells are coagulated and undergo necrosis and are believed to serve as a source of toxins that are absorbed with resulting serious systemic effects

There is a marked and diffuse capillary bed dilatation with an associated increase in capillary permeability This vascular reaction results in an outpouring of tremendous amounts of fluid into the interstitial tissue spaces about the burnt area Fluid also escapes from the burnt tissue cells and lymphatics The amount of fluid lost in the interstitial spaces about the burnt area can be very misleading since it can and often does represent a substantial percentage of the total circulating fluid volume The escaping fluid is not plasma per se, but is very similar

*"Initial Treatment of Burns in Mass Casualties by Kent L. Brown and Donald M Glover Cleveland Ohio J.A M.A Vol 165 No 6 643 646

B MANAGEMENT
1 Levin-Wangensteen Suction continuous throughout night
2 S S Enema (2 qt) night before surgery
3 Preoperative blood transfusions to improve blood quality
4 Nothing by mouth after 6 00 P M , no water after midnight
Prep abdomino perineal, (from nipples to mid-thighs)

C MEDICATION
1 Antiseptic mouth washes (Hydrogen peroxide mixed half and half with water), q hourly
2 Nembutal gr 1½ orally, or Phenobarbital gr 2 via (hypo) if Levin-Wangensteen suction is going
3 Check with patient for any drug or antibiotic sensitivity, if not sensitive, give Combiotic 1 amp (full strength) (I M) night before surgery, (on order of Surgeon)
4 Demerol—75 to 100 mg } 1 hr before surgery
Scopolamine—gr 1/150 }
5 ACTH, Cortisone, and cortisone derivatives have proven beneficial in alleviating symptoms resulting from idiopathic forms of hyemolytic anemias and thrombocytopenic purpuras

II IN OPERATING ROOM
A Administer blood during the surgery at a rate commensurate with the need
B **In congenital hemolytic jaundice the possibility of encountering a severe reaction during a blood transfusion is great, whenever possible, we try not to administer blood until after the splenectomy**

III POSTOPERATIVE ORDERS
A See ' Laparotomy Postoperative Orders ', in addition order
1 Blood transfusions as indicated
a) Have a cut down (16-18 gauge) needle or polyethylene tubing in place during and after surgery
b) Repeat routine and special blood studies as required
c) Hematological consultations as required and as ordered by Surgeon

B MANAGEMENT

1 Levin-Wangensteen Suction, continuous throughout night
2 S S Enema (2 qt) night before surgery
3 Preoperative blood transfusions to improve blood quality
4 Nothing by mouth after 6 00 P M , no water after midnight
Prep abdomino perineal (from nipples to mid thighs)

C MEDICATION

1 Antiseptic mouth washes (Hydrogen peroxide mixed half and half with water), q hourly
2 Nembutal gr 1½ orally or Phenobarbital gr 2 via (hypo) if Levin-Wangensteen suction is going
3 Check with patient for any drug or antibiotic sensitivity, **if not sensitive,** give Combiotic 1 amp (full strength) (I M) night before surgery (on order of Surgeon)
4 Demerol—75 to 100 mg } 1 hr before surgery
Scopolamine—gr 1/150 }
5 ACTH, Cortisone and cortisone derivatives have proven beneficial in alleviating symptoms resulting from idiopathic forms of hyemolytic anemias and thrombocytopenic purpuras

II IN OPERATING ROOM

A Administer blood during the surgery at a rate commensurate with the need

B **In congenital hemolytic jaundice the possibility of encountering a severe reaction during a blood transfusion is great, whenever possible, we try not to administer blood until after the splenectomy**

III POSTOPERATIVE ORDFRS

A See Laparotomy Postoperative Orders" in addition order

1 Blood transfusions as indicated
a) Have a cut-down (16-18 gauge) needle or polyethylene tubing in place during and after surgery
b) Repeat routine and special blood studies as required
c) Hematological consultations as required and as ordered by Surgeon

BURNS

I GENERAL CONSIDERATIONS

Today the possibility of mass disasters resulting from peacetime accidental atomic explosions and atomic warfare has become a reality—and greater stress must be placed upon the "mass management' of blast and thermal effects, as well as nuclear irradiation Burns have now become the concern of everyone All available manpower must be mobilized to meet this emergency and must include doctors, nurses, orderlies administrative personnel and non technical groups Emergency auxiliary help will come from Civil Defense and Red Cross organizations The philosophy in dealing with mass burn casualties is not different from that in handling mass war injuries The objective is to give primacy in treatment to those individuals most likely to survive their trauma *

II DEFINITION

A burn is a surgical wound and as such bleeds", not blood, but plasma into the wound and surrounding tissues This is the so-called **"white hemorrhage" of Koch The concept that a burn is a wound requiring the same aseptic precautions followed in any surgical wound is not yet fully appreciated** A burn has the following features in common with a surgical wound

1 Skin disruption
2 Hemorrhage (white hemorrhage')
3 Bacterial contamination
4 Shock

III PATHOLOGY OF BURNS

A LOCAL PATHOLOGY OF THERMAL BURNS

The pathological changes incurred by a severe burn may not subside for several days In an electrical burn demarcation of dead from living tissue may require weeks This fact influences the type and duration of burn management The burnt cells are coagulated and undergo necrosis and are believed to serve as a source of toxins that are absorbed with resulting serious systemic effects

There is a marked and diffuse capillary bed dilatation with an associated increase in capillary permeability This vascular reaction results in an outpouring of tremendous amounts of fluid into the interstitial tissue spaces about the burnt area Fluid also escapes from the burnt tissue cells and lymphatics The amount of fluid lost in the interstitial spaces about the burnt area can be very misleading since it can and often does represent a substantial percentage of the total circulating fluid volume The escaping fluid is not plasma per se but is very similar

*"Initial Treatment of Burns in Mass Casualties by Kent L. Brown and Donald M Glover Cleveland Ohio J A.M.A. Vol 165 No 6 643 646

B MANAGEMENT

1 Levin Wangensteen Suction, continuous throughout night
2 S S Enema (2 qt) night before surgery
3 Preoperative blood transfusions to improve blood quality
4 Nothing by mouth after 6 00 P M , no water after midnight
Prep abdomino-perineal (from nipples to mid-thighs)

C MEDICATION

1 Antiseptic mouth washes, (Hydrogen peroxide mixed half and half with water), q hourly
2 Nembutal gr 1½ orally, or Phenobarbital gr 2 via (hypo) if Levin-Wangensteen suction is going
3 Check with patient for any drug or antibiotic sensitivity if not sensitive, give Combiotic 1 amp (full strength) (I M) night before surgery (on order of Surgeon)
4 Demerol—75 to 100 mg; Scopolamine—gr 1/150 } 1 hr before surgery
5 ACTH Cortisone and cortisone derivatives have proven beneficial in alleviating symptoms resulting from idiopathic forms of hyemolytic anemias and thrombocytopenic purpuras

II IN OPERATING ROOM

A Administer blood during the surgery at a rate commensurate with the need

B **In congenital hemolytic jaundice the possibility of encountering a severe reaction during a blood transfusion is great, whenever possible, we try not to administer blood until after the splenectomy**

III POSTOPERATIVE ORDERS

A See Laparotomy Postoperative Orders , in addition order

1 Blood transfusions as indicated
a) Have a cut-down (16-18 gauge) needle or polyethylene tubing in place during and after surgery
b) Repeat routine and special blood studies as required
c) Hematological consultations as required and as ordered by Surgeon

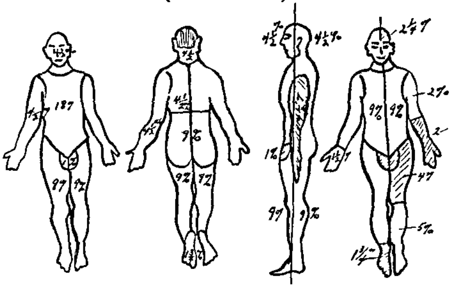
2ND DEGREE BURN—(VESICULATION)

1 Necrosis of outer layer only
2 Vesiculation and superficial sloughing
3 Infection occurs often
4 *Epithelial regeneration usually occurs rapidly,* 10-20 days

3RD DEGREE—(FULL THICKNESS BURN)

1 Burn extends down to fatty layer, may extend to muscle and bone
2 No hair follicle or sweat gland elements are left to affect epithelial regeneration Healing is usually followed by scarring, (Eschar)
3 Infection and anemia usually accompany 3rd degree burns
4 The burnt tissue usually separates from the unburnt tissue in from 5 to 12 days—but occasionally it may slough away more slowly

FIG III
BERKOW'S DIAGRAM (RULE OF 9)



These diagrams permit a rapid estimation of percentage of body surface burned according to Berkow s Rule or Rule of Nine

THERMAL BURNS—*are the most important* effects of atomic blasts Approximately 50-75% of the cases exposed will eventually result in thermal burns

Thermal Effects are of two types

1 **Flash** (or Primary) burns accounted for about 95% of the atomic burns sustained at Hiroshima and Nagasaki It is caused by the ultra violet rays in blast light Treatment of flash burns is almost *identical with that of flame* burns, they will be discussed jointly under Burn Treatment'

to it It contains the same amount of electrolytes, but is quite lower in protein concentration

B SYSTEMIC PATHOLOGY OF THERMAL BURNS

1 **Systemic effects**—usually accompany large burns but may also follow smaller ones Death may follow a severe systemic reaction
2 Pathologic changes in organs remote from the local burn may be caused by a serious decrease in the circulating fluid volume, this can further lead to **dehydration** and **anoxia** with resultant **dysfunction of the affected organs Irreversible changes may occur in the brain, kidneys and liver**
3 **Gastro intestinal Tract**—effects may include anorexia, vomiting and ileus, hematamesis and melena may indicate the development of a rare Curling Ulcer'
4 **Respiratory Tract**—changes may depend upon whether hot fumes, flames or gases were inhaled Edema of the larynx and tracheobronchial tree may lead to asphyxiation Tracheotomy may have to be considered
5 ***Cardiovascular System**—changes are due mainly to a markedly reduced circulatory fluid volume They are*
   a) Shock
   b) Thrombophlebitis
   c) Phlebothrombosis
6 ***Endocrine System**—changes are due primarily to* the ALARM REACTION of Selye This reaction is characterized by an increase in the ketosteroid excretion and drop in the Eosinophil count A negative nitrogen balance results from increased urinary nitrogen loss
7 **Hematological System**—changes are twofold
   a) **Hemoconcentration**—results from a tremendous transudation of fluid from the vascular tree into the surrounding tissues of the burnt area This shift of fluid leads to a decreased circulating fluid volume and an increase in the concentration of all cellular elements—except protein values, the latter remaining normal or subnormal
   b) **Red cell destruction** is due to
      1 **Immediate contact** of red cells with the intense heat or flame
      2 **Later development** of increased red cell fragility

C CLASSIFICATION OF BURNS

Our classification of Burns depends upon the degree of local pathological involvement.

1ST DEGREE BURN—(ERYTHEMA)

1 Hyperemia but no necrosis
2 *Desquamation (peeling), occurs later*
3 Pigmentation

The **LOCAL CARE** of the burn wound must progress along with the overall **GENERAL CARE** of the patient One cannot be separated from the other because a successful result is contingent upon the judicious employment of both Death may occur from neglect of either factor

Local and general management of burns in children are more serious, more difficult and more extensive than in adults for the following reasons

1 Smaller blood volume in children
2 Burn shock more severe in children
3 Rapid weight loss occurs in children
4 Higher percent of skin surface involvement
5 Thinner skin allows deeper burns to develop
6 Greater susceptibility to exanthematous diseases

The treatment of burns in industrial or wartime disasters is similar to the routine treatment of burns in civilian life THE SAME SURGICAL PRINCIPLES PERTAIN The surgeon should never forget that burn treatment is time consuming and that he must adhere to the following established surgical principles throughout

1 Management of shock takes precedence over any other treatment
2 Aseptic precautions (i e special rooms caps and masks, temperature control, etc)
3 Maintainance of Fluid Electrolyte and Nutritional Balance, (early intermediate and late)
4 Early wound closure, (i e special dressings, autogenous grafts homografts and bank or stored grafts)

NOTES

2 **Flame** (or Incendiary) burns comprised 5% of the burns sustained at Hiroshima and Nagasaki

Irradiation exposure affected approximately 20% of the population, the mortality rate was enhanced 5 times

IV DIAGNOSIS OF BURNS

A SIGNS AND SYMPTOMS

1 Pain and thirst, (dehydration)
2 Restlessness, (anoxia)
3 Skin pale, cold and clammy, (shock)
4 Quiet and apathy (may indicate incipient shock)
5 Oliguria and anuria (Hemoconcentration and decreased circulating fluid volume
6 Pulse } Increased—(Primary shock and dehydration)
7 Respiration } Increased—(Primary shock and dehydration)
8 Temperature increased—(Central stimulation and toxic absorption)
9 Blood pressure
   a) Drops **moderately** after burn
   b) Drops **decidedly** in shock
   c) Drops **profoundly** preceding death

B LABORATORY—Blood studies are ordered stat, and q 3 hrs for 24 48 hrs

1 R B C } Increased due to hemoconcentration
2 W B C } Increased due to hemoconcentration
3 Hemoglobin } Increased due to hemoconcentration
4 Hematocrit } Increased due to hemoconcentration
5 Total Plasma Proteins—**"Normal"**
   a) Because large quantities of plasma like fluid containing protein escape from the vascular tree into the tissue spaces, the hemoconcentration fails to reveal a concomitant rise in protein value Thus a normal protein reading in the presence of increased values for all other blood elements indicates an **actual and great loss of plasma proteins**
6 Urinary ketosteroids—Increased } Alarm Reaction (Selye)
7 Urinary Nitrogen—Increased } Alarm Reaction (Selye)
8 Eosinophil count—Decreased } Alarm Reaction (Selye)

V MANAGEMENT OF BURNS

TREATMENT—takes into consideration

1 Cause
2 Duration
3 Estimated extent and depth
4 Presence or absence of shock
5 Possibility of bacterial contamination
6 Available facilities and personnel

ployed depending upon prevailing conditions and the surgeon **We recommend *avoiding the "open method"* whenever the threat of contamination exists and where warmth necessary to keep the patient out of shock is wanting**

A MANAGEMENT OF SHOCK

Treat shock in anticipation of it—don't wait for late, obvious and *irreversible* circulatory collapse associated with profound blood pressure drop to develop

Treatment of shock takes precedence over all other medical and surgical considerations, it must be instituted as quickly as *possible and preferably in anticipation of it*

1 BED REST—LOWER HEAD OF PATIENT

2 BLOOD PLASMA AND FLUID REPLACEMENT AIMS AT

a) Getting blood volume and blood concentration back to *normal*

b) Obtaining adequate urinary flow

1) Catheterize patient with Foley catheter

2) Check excretory output

3) *Use as index to improved blood volume*

c) Improving Oxygen saturation of the blood and tissues

d) Correcting blood volume with

1) **Whole blood** should preferably be used where whole *blood was lost*

2) **Plasma** should preferably be used where plasma per se was lost

3) **Human Albumin** (salt poor), is used where a *marked protein deficiency exists, it has been utilized* in the treatment of shock during the war

4) **Dextran** (blood expander)—has served well when plasma or blood were not available In rare instances *Dextran worked where blood and plasma failed*

5) **I V Fluids**—i e Ringer s, Hartman's, 1/6 *Molar* lactate, and Physiological Saline Solutions **The latter fluids are crystalloid solutions—not colloidal, and *therefore should be administered only* when whole blood, plasma or blood expanders are not available**

3 RULES FOR BLOOD, PLASMA AND FLUID REPLACEMENT ARE ONLY APPROXIMATE WORKING RULES

ALL RULES MUST *FINALLY BE TEMPERED* BY THE CLINICAL RESPONSE OF THE PATIENT, AND THE CLINICAL EXPERIENCE AND JUDGMENT OF THE *SURGEON*

a) ***Rule based on percent of burnt*** surface

TREATMENT OF BURNS IS DIVIDED INTO FOUR PHASES

1 **FIRST-AID TREATMENT**
   a) *Professional or layman*

2 **IMMEDIATE TREATMENT**
   a) Initial plan of treatment instituted at
      1) Home
      2) Factory
      3) Improvised shelter, or
      4) Hospital

3 **INTERMEDIATE TREATMENT**
   a) This is a follow-up plan of definitive treatment, and depends upon the extent and progress of the burn, and also upon whether or not sloughs are present
   b) Treatment varies, depending upon whether the burn wound presents clean or infected granulation
   c) Closed method (Dressing method)—or Open Method (Exposure Method)
   d) Intermediate Nutritive Care
   e) Intermediate Skin Grafting

4 **LATE TREATMENT**
   a) **COMPLICATIONS**
      1) Infection
      2) Anemia
      3) Contractures
         a) Prophylactic treatment
         b) Active treatment
            1) Plastic Surgery
            2) Late Skin Grafting

I. FIRST-AID TREATMENT

A Professional or layman

1 First Aid care may have to be carried out at home first-aid station, emergency room in hospital, or shelter improvised during atomic warfare, i e garages factories, schools, etc

2 Hospital teams Civilian Defense Teams and Red Cross Teams should be taught modern first-aid treatment for mass burn casualties

3 Instruct laity to do no more than cover the burnt surface with sterile or clean dressings

4 Do not apply salves, butter lard or medicated ointments to burns

5 Keep patient quiet warm and preferably flat during trans port, keep associated injuries, (i e abdomen head and spine) in mind

II IMMEDIATE (DEFINITIVE) TREATMENT

'Open or Closed methods of burn treatment may be em-

dures—I V administration of Hydrocortisone may restore the patient's hemodynamics **It must be remembered that ACTH, Cortisone, and Hydrocortisone may be used as a supplement to, but not as a substitute for the accepted methods of shock therapy listed above**

f) On occasion, Levophed, (Norepinephrine), may be utilized to great advantage

6 ENVIRONMENT

a) Maintain a warm room, avoid overheating patient
b) Avoid drafts

7 OXYGEN

Oxygen (90%) should be employed whenever signs of anoxia, cyanosis and dyspnea develop

a) **Intra nasal catheter**—6-8 liters per minute, this form of *oxygen administration is efficient*
b) **Oxygen Tent**
c) B L B Mask etc

B SURGICAL MANAGEMENT OF BURNS

At present there are two widely accepted methods of **local *treatment of burns***

1 CLOSED METHOD (DRESSING METHOD)
2 OPEN METHOD (EXPOSURE METHOD)

One must remember that **local** and **systemic** treatment are instituted simultaneously—one being incomplete without the other

CLOSED (DRESSING) METHOD

1 STRICTEST ASEPTIC PRECAUTIONS ARE OBSERVED AT ALL TIMES

a) **Cap and mask**—should be worn by all personnel, including the patient
b) **Sterile gown and gloves** worn by Surgeon
c) **Avoid undue manipulation** of patient, soak or cut off clothes
d) **Cleanse wound gently** with sterile soap and water
e) **Debride wound** of devitalized and necrotic tissue, remove *all foreign bodies, avoid injury* to exposed blood vessels and nerves
f) **DO NOT OPEN INTACT BLISTERS!**
g) **Routine bacterial cultures** taken of burn-surfaces Request direct smears as well as culture and sensitivity studies

2 MEDICATION—covers both **prophylactic** and **active** requirements

a) **Tetanus Anti-Toxin**—3000 6000 u, is given **routinely**, may be administered in divided dosage Remember to first skin test patient If patient has been previously vac-

Give 150 cc plasma for every 1% of burnt body area for the first 24 hours

b) **Rule based on Hematocrit, (Harkin's)**

For every 1 point above normal hematocrit of 45, give 100 cc plasma for 24 hours In addition, for every 1 Gm total blood protein fall below 6 Gms per 100 cc give 25% over the estimated amount

NOTE This rule may be used for blood, plasma or blood expanders (i e Dextran) Early masked burn anemia" may lead to low hematocrit readings and underestimation of the true fluid replacement

c) **Rule based on Hemoglobin**

For every 1% above 100% Hemoglobin administer 50 cc plasma for 24 hours

4 **ORAL FLUIDS**

a) Water alone should not be administered electrolyte solution is the preferred form of fluid replacement (orally and/or intravenously)

1 teaspoonful Sodium Chloride (NaCl) ½ teaspoonful Sodium Bicarbonate ($NaHCO_3$)	add to 1 liter of water

b) Avoid oral route alone—because if patient vomits after 8 hours a serious fluid loss may result that cannot be easily corrected

c) Give

Adults—150-200 cc fluids q hourly
Children—75-100 cc fluids q hourly

d) Avoid replacing excess fluids when blood proteins are low, hypoproteinemic blood has a low osmotic pressure and cannot hold an excess of water or saline, excess fluid will simply pass into the tissues and produce edema

e) Record and Chart Fluid Intake and Output

5 **DRUGS**

a) **Morphine is too dangerous**—and is therefore contraindicated in severe burns associated with shock

b) **Barbiturates**

1) **Barbiturate suppositories for infants**
2) **I V Pentothal Sodium**—is ideal for children and adults

c) **Avoid anesthesia in patients suspected of incipient shock.**

d) **Stimulants are used—only if required**

e) ACTH, Cortisone and Hydrocortisone have been employed in burn shock but their value is still controversial In cases of **resistant shock,** unresponsive to above proce-

1) First apply sterile petrolatum or *Xeroform impregnated gauze strips in single layer over and beyond burnt surface
2) Cover Petrolatum—or Xeroform impregnated gauze strips with flat, dry dressings
3) Tamponade Dressing is created by applying fluffed gauze or sterile mechanic's waste over the flat dressings—then pressing it down snugly with roller gauze, stockinette or Ace Elastic bandage
   (a) The tamponade dressings must be snug enough to prevent further exudation of plasma into the tissues—yet not so tight as to interfere with circulation
   (b) Splint-dressing—effectively immobilizes affected part
   (c) Check dressings daily, re-enforce them when necessary
4) Original Tamponade Dressing should not be changed for 5 to 10 days if possible **Infection necessitates an earlier change of dressing** Some surgeons routinely inspect burn after the third day Dressings are usually removed down to the petrolatum impregnated gauze dressing **if wound is infected the petrolatum-gauze or Xeroform gauze dressings are removed** and are replaced by wet dressings of Physiological Saline or ½ strength Dakin's Solution The wet dressings are preferably kept moist and are changed daily

4 **PLAN FOR DRESSING-APPLICATION TO INFECTED BURN (CLOSED METHOD)**

a) **Cleanse wound**—carefully and gently with sterile soap and water Employ continuous irrigation while cleansing wound All personnel wear caps and masks—including patient **Observe all aseptic precautions**
b) Remove all crusts foreign matter and necrotic tissue
c) **First dressing application is warm wet dressings of Physiological Saline Solution** placed over burn wound and covered with dry flat sterile dressings
d) Gauze dressings are opened to create a 'fluffy dressing" which is applied over the initial dry dressings, this creates a mild and desirable tamponade pressure dressing (Sterile mechanics-waste may be used instead of ' fluff")
e) To remove necrotic material from infected burnt area apply 50% Dakin s Solution, (½ Dakin s Solution and ½ Physiological Saline Solution)
f) **Daily warm wet dressings**—until burnt surface shows

*Xeroform—(Bismuth Tribromphenate)

cinated, give a "booster-shot" of Toxoid

b) **Polyvalent Gas Gangrene Anti Toxin** is employed when indicated

c) **Antibiotic or Chemotherapy—is employed routinely in all burns** (See 'Antibiotics")

1) **Penicillin**—is effective against most streptococci, it is most effective against Beta-streptococci and least effective against the staphylococci Penicillinase, an enzyme elaborated by gram negative coliform organisms inactivates penicillin After 2 or 3 weeks of continued administration, Penicillin may lose its effectiveness

*2) **Terramycin**—Oxytetracycline), 500-1000 mg in 1000 cc I V fluids, daily

*3) ***Achromycin***—*(Tetracycline), 500-1000 mg in 1000* cc I V fluids, daily

*4) **Aureomycin**

*5) **Streptomycin**

*6) **Chloromycetin**—(Chloramphenicol)

*7) **Neomycin**

*8) **Bacitracin**

*9) **Sulfasuxadine and Sulfathaladine**—are not affected by Penicillinase they are most effective against alpha and gamma streptococci and least effective against staphylococci

(a) Before giving Sulfasuxadine Neomycin or Bacitracin the urinary output and PH of the urine should be checked A minimum urinary output of 2500 cc is essential

10) **Triple Sulfa drugs**

11) **Aerosporin, (Polymyxin B)**

12) **Ristocetin** has demonstrated effectiveness against Hemolytic Staphylococci (See "Antibiotics)

13) **Kanomycin** and **Vancomycin** (See Antibiotics)

3 **APPLICATION OF TAMPONADE BURN DRESSING AND IMMOBILIZATION OF WOUND**

a) This phase of burn treatment accomplishes the following

1) Converts an open wound into a closed one
2) Prevents continued plasma loss into tissues
3) Prevents external contamination
4) Immobilizes (splints) affected areas and facilitates healing

b) **Plan for Application of Dressings to clean burn**

*These drugs may be routinely employed whenever bacterial contamination with coliform and clostridial organisms occurs as in burns about the anus perineum and lower extremities. Wash perineum after each bowel movement since droppings continue to contaminate wounds about the perineum and lower extremities

c) 3 to 7 days later, the new granulating surface may be grafted

2 CHEMICAL DEBRIDEMENT

a) 1% Pyruvic acid in acid-starch paste applied daily is effective in separating and removing slough and promoting granulations for subsequent grafting The disadvantages of this method are pain, irritation and possible infection We do not recommend this method

3 ENZYMATIC DEBRIDEMENT

a) Varidase—(Streptokinase and Streptodornase)

b) Tryptar—(Trypsin Chymotrypsin) a proteolytic enzyme

B MAINTAINANCE OF BURNED PATIENT

This phase of burn management is directed at preventing or correcting

1 Nitrogen imbalance
2 Weight loss
3 Secondary anemia
4 Chronic infection

1 DIET

a) **Increased Protein Intake**
   1) 2-3 Gms Protein per/kgm body weight
   2) Employ protein supplements, (Protonal, Meritene etc)
   3) May employ forced feedings via gastric catheter

b) **Increased Vitamin Intake**
   1) Multi vitamins, oral I M and I V routes

c) **Fortify Diet to Prevent Anemia**
   1) Liver extract
   2) Folic acid
   3) Vitamin B_{12}
   4) Vitamin B-Complex (Solu B, Folbesyn etc)
   5) Iron and Copper

2 SPECIFIC TREATMENT FOR BURN-ANEMIA

a) Transfusions of whole blood started early
   1) Do not give blood prophylactically

b) Packed R B C s in Physiological Saline Solution
   1) Blood Volume Studies will indicate whether packed R B C s plasma or whole blood is indicated

c) Mixture of plasma and blood
   1) Ratio of 2 1

d) Chemotherapy—to prevent anemia resulting from infection

e) Differentiate Pseudo-Burn Anemia which appears before 1st week Pseudo-anemia' results from hemodilution that subsequently follows hemoconcentration

1) Fresh red (non infected) granulations
2) Almost or complete healing (Epithelialization)

g) **WHEN GRANULATIONS ARE FRESH RED (UN INFECTED), REINSTITUTE ORIGINAL TREATMENT (CLOSED METHOD), AS FOR CLEAN BURN**

5 **OPEN (EXPOSURE) METHOD**

a) The open (or exposure) method of treating a burn is not new, it dates back to 1905 The exposure method depends upon the body s own secretions (plasma or serum), to cover the wound by forming a **'protective top crust'** layer

b) The open method is best suited for burns on one side of the body (i e) chest, buttocks, back, face and occa sionally the hands, it particularly is suited to cases that do not have to be transported

c) The 'open method is not well suited for circumferential burns The patient requires repeated turning under sterile precautions whenever cracks are created or top crusts rubbed off the protective effect is lost and bacterial invasion is inevitable

d) **Advocates of the 'open (exposure) method' claim the following advantages**
   a) Less infections noted
   b) Practical plan of therapy in mass disasters
   c) Shorter healing period with less complications

e) **Antagonists of the 'open method' claim the following dis advantages**
   a) Transportation of burn patients is hazardous
   b) Shelter and warmth should be available
   c) Circumferential body burns cannot be ideally treated
   d) We believe that 3rd degree burns respond best to the closed or dressing method of treatment

C Signs and symptoms indicating presence of infection are
1 Drainage—serous or sero purulent
2 Temperature—102°-104° F after 72 hours
3 Foul odor
4 Pain

III **INTERMEDIATE TREATMENT**

A **PLAN FOR DEBRIDEMENT OF 3RD DEGREE BURNS**

1 **SURGICAL (EXCISION) DEBRIDEMENT**

a) Under general anesthesia on the 6th to 12th day the slough may be excised along a plane of cleavage This may be accomplished in 1 or more stages depending upon the condition of patient and extent of burn

b) Transfusion during surgery covers blood loss

c) 3 to 7 days later, the new granulating surface may be grafted

2 CHEMICAL DEBRIDEMENT

a) 1% Pyruvic acid in acid-starch paste applied daily is effective in separating and removing slough and promoting granulations for subsequent grafting The disadvantages of this method are pain, irritation and possible infection We do not recommend this method

3 ENZYMATIC DEBRIDEMENT

a) Varidase—(Streptokinase and Streptodornase)

b) Tryptar—(Trypsin Chymotrypsin) a proteolytic enzyme

B MAINTAINANCE OF BURNED PATIENT

This phase of burn management is directed at preventing or correcting

1 Nitrogen imbalance
2 Weight loss
3 Secondary anemia
4 Chronic infection

1 DIET

a) **Increased Protein Intake**
   1) 2-3 Gms Protein per/kgm body weight
   2) Employ protein supplements, (Protonal, Meritene etc)
   3) May employ forced feedings via gastric catheter

b) **Increased Vitamin Intake**
   1) Multi-vitamins oral, I M and I V routes

c) **Fortify Diet to Prevent Anemia**
   1) Liver extract
   2) Folic acid
   3) Vitamin B_{12}
   4) Vitamin B Complex (Solu-B Folbesyn, etc)
   5) Iron and Copper

2 SPECIFIC TREATMENT FOR BURN ANEMIA

a) Transfusions of whole blood started early
   1) Do not give blood prophylactically

b) Packed R B C 's in Physiological Saline Solution
   1) Blood Volume Studies will indicate whether packed R B C s, plasma or whole blood is indicated

c) Mixture of plasma and blood
   1) Ratio of 2 1

d) Chemotherapy—to prevent anemia resulting from infection

e) Differentiate Pseudo-Burn Anemia which appears before 1st week Pseudo-anemia' results from hemodilution that subsequently follows hemoconcentration

The result is increased blood volume Transfusions given unnecessarily would only serve to overload the circulation and possibly result in cardiac embarrassment **Avoid giving transfusions in anticipation of burn anemia First ascertain whether blood is needed before administering transfusions**

IV LATE TREATMENT

A This phase of treatment deals with **burn complications**

1 INFECTION

a) See— Surgical Management of Burns'

b) See—"Surgical Management of Infected Burns

c) See— 'Antibiotics in Surgery

2 ANEMIA

a) See— Maintainance of Burn Patient"

3 CONTRACTURES

a) **PROPHYLACTIC TREATMENT**

1) First and second degree burns usually do not require late treatment The sebaceous and sweat glands serve as precursors to re epithelialization

2) Third degree burns involve the full thickness of skin and thereby heal by granulation Early skin grafting will usually prevent subsequent contracture formation and affect earlier healing **As a rule—the sooner epithelialization is accomplished, the less chance will there be for contracture**

3) Skin grafting should preferably be carried out on a pinkish flat granulation surface and not upon a chron *ically infected and hypertrophic granulation bed*

4) To further improve the chances for a successful skin graft—one should constantly observe certain local and general precautions, (i e)

(a) Effective control of infection

(b) Flattening of granulation surface*, and

(c) Improvement of the patient s general nutritional status (See—Maintainance of Burn Patient)

5) If large skin grafts fail to take multiple smaller split-thickness grafts should be attempted

6) Flexor surfaces, (i e) elbow, popliteal, axillary and cervical areas tend to contract more easily and therefore should be skin grafted earlier Several stage procedures may be required and it should be remem bered that donor sites may be used repeatedly

B ACTIVE TREATMENT

1 Cicatricial contractures result from destruction of the epi

*Irregular hypertrophic granulations may be primarily shaved down at surgery just before grafting procedure

dermal layers and from failure to observe the rules of ideal splinting of movable sites The sites most commonly involved are the axilla, elbow, groin and neck

2 Early skin-grafting is recommended, there may be instances where skin grafting is contraindicated (i e) a poor general nutritional status, non availability of skin, and presence of infection

3 Where early skin grafting cannot be carried out, proper immobilization of the affected parts must be carried out
   a) **Burns of the knee or elbow** should be immobilized in maximal extension on a posterior mold splint
   b) **Burns of the axilla** should be immobilized with the arm at right angle abduction and elbow flexed at 90°, (aeroplane splint)

4 If contractures begin to develop despite every precaution the surgeon should not resort to force, he should instead plan to skin-graft earlier It should be remembered that forceful extension of the burnt area may result in even greater production of fibrous tissue (desmoplasia) with subsequent contracture Forceful extension of burnt areas may also lead to fissures or cracks which in turn predispose to infection and further contracture

5 After healing and epithelialization has taken place, physical therapy should be instituted

6 **Operative Procedures**—are necessary to correct contracture deformities and ugly scars Some of the procedures employed are
   a) **Incision or excision of scar contractures,** followed by skin-grafting
   b) **Z-Operation** is a method of choice for undoing web scars
   c) **Grafting Methods**—(see surgical texts dealing with technic of grafting) **Split thickness grafts** are preferred **Full thickness** grafts have less chance of successful take **Flap (full thickness), or Pedicle Graft** is employed when despite a take' with split thickness graft the contracture still persists or when major arteries and nerves are exposed without a fatty bed to protect them

C BURNS OF FACE, EXTREMITIES AND PERINEUM

1 Extensive burns of the face, extremities and perineum require special consideration In first and second degree burns we have employed the open method for years with gratifying results
   a) No surface coagulants should be used, they are uncomfortable and only invite infection
   b) After careful debridement cover burnt surfaces with a

fine layer of bland ointment, then cover with a fine mesh gauze

c) Deep burns of the eyelids eventually lead to contractures, (ectropion) This type of contracture can be prevented by temporarily suturing the eyelids together

NOTES

ORDERS FOR MANAGEMENT OF SURGICAL SHOCK

The exact mechanism of shock is not known The various definitions of shock attest only to how little it has been understood By our definition, SHOCK IS A SYNDROME CHARACTERIZED BY A DISPARITY BETWEEN THE CIRCULATING BLOOD VOLUME AND THE CAPACITY OF THE PERIPHERAL VASCULAR BED, WITH TISSUE ANOXIA RESULTING FROM CIRCULATORY FAILURE

SHOCK occurs after acute hemorrhage (internal or external), severe wounds and extensive burns, also, shock accompanies severe infections and acute dehydration diseases (i e) *diarrhea, vomiting and* draining wounds

The SYMPTOMATOLOGY varies only in degree The PHYSICAL CHANGES in shock are *fairly* well established They are *decreased* blood volume, decreased cardiac output, (reduced blood volume flow), increased hemoconcentration and ANOXEMIA Primarily, there is a marked circulatory deficiency or collapse

The CLINICAL SIGNS related to these changes are increased pulse rate of weak intensity collapse of the superficial veins, pallor and coldness of the extremities, diminishing depth and increasing rate of respiration decompensation of the circulation and a progressive fall in blood pressure **Anoxemia is probably the most important factor in prolonging the *vicious circle associated with shock***

Regardless of what theory one advocates one thing is certain—**if the patient isn't treated soon and effectively—he will die!**

When shock is severe and too prolonged, the *patient will usually die* There can only be one *ideal treatment for shock*—namely, **prophylactic treatment** **Early treatment** is in reality prophylactic therapy against the development of the full-blown picture of irreversible shock **Late treatment—regardless of what means are employed—is likely to** *be ineffective!*

One theory of **SHOCK PATHOGENESIS** postulates in shock **oligemia** develops with a compensatory hyperreactiv[illegible] minal vascular bed that results in vasoconstriction. Later [illegible] lost and is followed by a general *capillary dilat*[illegible] *trapping or pooling of blood* The circulating blood [illegible] illary blood flow both become further reduced [illegible] tissues ensues Continued hemoconcentration [illegible] Cardiac output is further reduced because [illegible] and myocardial anoxia The *important* [illegible] around what causes the peripheral *cap*[illegible] where any replacement of blood pla[illegible] effect

BIOCHEMICAL CHANGES that accompany shock are

1 **PROTEIN CATABOLISM**—Evidenced by an increase of plasma amino peptidose and amino acids

2 **ALTERED LIVER FUNCTION**

a) At first increased as evidenced by increased urea output

b) Later function is reduced due to hepatic anoxia this is evidenced by a drop in urea and rise in amino acids

c) Liver anoxia leads to a serious alteration in carbohydrate metabolism

d) Irreversibility of shock believed due to

1) Increase in anaerobic glycolysis

2) Drop in adosine triphosphate, (A T P)

3) Anoxemic acidosis

e) Reduced coronary flow leads to myocardial ischaemia, depression of cardiac output reduced renal blood flow renal anoxia and oligemia These events contribute to the IRREVERSIBILITY OF SHOCK

3 Schorr Sweifach et al (Cornell Medical Center) implicate **vasotrophic humoral principals** present in the blood stream during shock

a) **Vasoexcitor material**—(V E M)

1) Induces hyper-reactivity to metarterioles

b) **Vasodepressor material**—(V D M)

1) Induces hypo-reactivity to metarterioles

c) During the initial or compensated stage of Shock, V E M was found to predominate only to disappear gradually from the blood as V D M was found to accumulate in increasing amounts

I PROPHYLACTIC TREATMENT OF SURGICAL SHOCK

A PREOPERATIVELY

The treatment of surgical shock begins with correction of dehydration, hypoproteinemia and anemia also the control of fear anxiety and pain Therapy is directed to all interlocking problems concerned with the shock-state, surgical management includes blood volume correction or replacement while steps are taken to stop active bleeding Measures to prevent bacterial invasion must be instituted while the stage is set for eventual tissue healing Invasive infection is a common cause for relapse into shock of an injured patient who has already stopped bleeding One must keep in mind that clinical signs of sepsis may be overshadowed by the vascular collapse

B DURING SURGERY

Skillful surgical technic avoidance of undue trauma to tissues and minimal blood loss all tend to prevent shock

II ACTIVE TREATMENT OF SURGICAL SHOCK

A The active treatment of surgical shock is based upon the principle

of correcting known pathological processes as indicated by laboratory and clinical findings

1 Morphine sulphate gr 1/6 or more if necessary—TO KEEP PATIENT QUIET Record B P, Pulse and Respiration q ½ hr
2 Oxygen (nasal catheter or B L B mask) 7-10 liters per minute
3 External heat—Blankets and heat cradle The latter must be used with great caution because the patient may be adversely affected by excess heat or burn
4 Elevate foot of bed (6-8 inches) Trendelenberg or shock-position)
5 *Blood Volume Replacement*
   a) **Blood transfusions** whenever external blood loss occurs or is suspected i e, internal hemorrhage
   b) **Plasma transfusions** wherever plasma loss is suspected, i e burns and large open wounds
   c) **Fluid and Electrolyte** replacements wherever acute and chronic dehydration is suspected, i e, diarrhea, vomiting and draining sinuses
   d) ***Plasma substitutes,*** *i e, blood expanders (Dextran)*
   e) **Levophed**—(nor epinephrine Winthrop), is a **peripheral vaso constrictor,** and has been highly effective in maintaining blood pressure in the shock state In instances **where shock persists despite blood replacement,** Levophed has been effective in elevating and maintaining safe blood pressures In the latter instance continued fluid replacement is of no value—and may actually predispose *and lead to congestive heart failure Levophed* —effectively maintains blood pressure during **hypotensive states** associated with surgical procedures non-surgical trauma, hemorrhage and even in instances of central vasomotor depression During and after **Pheo chromocytomectomy,** Levophed effectively maintains blood pressure, especially after the tumor is excised with its contained autogenous epinephrine and nor-epinephrine (arterenol) Levophed has also been successful in elevating and maintaining blood pressure during **spinal anesthesia**
   f) **Wyamine**—(Wyeth), N-methyl *phenyltertiary* butylamine sulphate has been used **intramuscularly** in milder states of shock

g) **Aramine—(bitartrate)** — metaraminal bitartrate — (Merck) a new vasopressor drug—without the disadvantages of tissue slough necrosis and thrombophlebitis

6 NOTE the use of drugs which artificially stimulate cardiac or respiratory activity is discouraged DO NOT use adrena lin ephedrine, neosynephrine mecholyl, pitressin, coramine, alpha lobelin, etc , unless authorized by the surgeon

7 As regards control of shock due to injuries and blood loss during Atomic Warfare, the major factors to be concerned with are

a) Areas or centers of blood procurement
b) Blood preservation
c) Blood transportation
d) Methods and places for safe blood or plasma transfu sions
e) Development of plasma substitutes (blood expanders)
f) Organization of Services—to integrate blood or plasma replacement with other necessary surgical considera tions

8 **Adrenocortical Therapy**

a) Adrenocortical extract, (i e) cortisone and ACTH does not influence the course of experimental hemorrhagic shock that fails to respond to transfusions
b) In occasional patients where specific indications exist, benefit from adrenocortical therapy may occur
c) When shock is precipitated by a disproportionately mild stress—and the Eosinophil response is inadequate, an adrenal insufficiency should be suspected and treated

9 **Intra arterial Transfusion**—is employed as a resuscitative measure when the heart stops Blood given intravenously merely distends the veins and right atrium, whereas direct intra arterial infusion into the arterial system raises the aortic pressure and forces blood to flow through the coro nary arteries thereby aiding the restoration of myocardial contractions In the usual instances of surgical shock there is no proof that intra arterial transfusion is superior to intravenous transfusion We know that cardiac output usually responds to an increase in venous filling pressure and this is best accomplished by blood administered intravenously There are instances where continued administration of blood transfusions produce progressive congestion without appreciably raising the arterial pressure In these cases, a small intra arterial blood transfusion may produce marked improvement

COMPOUND FRACTURES AND INFECTED COMPOUND FRACTURES

BY

CARLO SCUDERI, M D , F A C S , F I C S

Sr Attending Surgeon at Cook County Hospital Chicago Ill Professor of Surgery at the Cook County Post-Graduate School of Medicine Chicago Ill

I TREATMENT OF COMPOUND FRACTURES

A IMMEDIATE MANAGEMENT—(At site of accident)

1 First Aid—treatment usually given by police or lay people
  - a) Cover wound with cleanest cloth available
  - b) Apply pressure to stop bleeding
  - c) SPLINT THEM WHERE THEY LIE!
  - d) Control pain
    - 1) Morphine sulphate gr ¼, record injection to avoid cumulative dosage during transport **Avoid morphine in head injuries**
  - e) Transportation—should be by ambulance if possible Avoid flexing (jack knifing) patient in rear of an auto
  - f) Warmth—should be maintained

B HOSPITAL MANAGEMENT

1 Treat shock immediately
  - a) Slight Trendelenberg position
  - b) Replacement of circulating fluid volume, if patient has lost blood, until patient is out of shock
    - 1) Whole blood transfusions
    - 2) Plasma
    - 3) I V fluids
  - c) Morphine sulphate
    - 1) Avoid in all head injuries and in children
  - d) Mild warmth to body
    - 1) Blankets
  - e) Oxygen (Intra nasal catheter)

2 Examine carefully for associated injuries
  - a) Skull fractures
  - b) Internal injuries
    - 1) Hemorrhage
      - (a) Spleen
      - (b) Liver
      - (c) Kidney
    - 2) Rupture of hollow viscus

3 Treatment of wound
  - a) Do not disturb original dressing
  - b) Apply sterile dressing where no dressing is present

g) **Aramine—(bitartrate)** — metaraminal bitartrate — (Merck), a new vasopressor drug—without the disadvantages of tissue slough necrosis and thrombophlebitis

6 NOTE the use of drugs which artificially stimulate cardiac or respiratory activity is discouraged DO NOT use adrenalin, ephedrine, neosynephrine, mecholyl, pitressin, coramine, alpha-lobelin, etc , unless authorized by the surgeon

7 As regards control of shock due to injuries and blood loss during Atomic Warfare, the major factors to be concerned with are

a) Areas or centers of blood procurement
b) Blood preservation
c) Blood transportation
d) Methods and places for safe blood or plasma transfusions
e) Development of plasma substitutes (blood expanders)
f) Organization of Services—to integrate blood or plasma replacement with other necessary surgical considerations

8 **Adrenocortical Therapy**

a) Adrenocortical extract, (i e) cortisone and ACTH does not influence the course of experimental hemorrhagic shock that fails to respond to transfusions
b) In occasional patients where specific indications exist, benefit from adrenocortical therapy may occur
c) When shock is precipitated by a disproportionately mild stress—and the Eosinophil response is inadequate, an adrenal insufficiency should be suspected and treated

9 **Intra arterial Transfusion**—is employed as a resuscitative measure when the heart stops Blood given intravenously merely distends the veins and right atrium, whereas direct intra arterial infusion into the arterial system raises the *aortic pressure and forces blood to flow through the coro*nary arteries thereby aiding the restoration of myocardial contractions In the usual instances of surgical shock there is no proof that intra-arterial transfusion is superior to intravenous transfusion We know that cardiac output usually responds to an increase in venous filling pressure and this is best accomplished by blood administered intravenously There are instances where continued administration of blood transfusions produce progressive congestion without appreciably raising the arterial pressure In these cases, a small intra arterial blood transfusion may produce marked improvement

1) Conservatively trim away wound edges
2) Conservatively cut away any tissue that is crushed or necrotic Avoid cutting away undue amount of skin and subcutaneous tissue
3) Remove only small and detached bone fragments
4) Save large bone fragments, wash them with soap and water and replace in wound
5) Remove necrotic bone with ronguer

II TREATMENT OF INFECTED COMPOUND FRACTURE

Compound fractures are usually considered infected

1 If patient is seen 8 hours or more after injury
2 If wound has foul odor
3 If signs of apparent infection or frank pus are present

A IMMEDIATE MANAGEMENT

(Same as listed under Compound Fractures)

B *HOSPITAL MANAGEMENT*

(Same as listed under Compound Fractures)

C TREATMENT (DEFINITIVE)

There are two acceptable plans of management for Compound Fractures

1 Primary Closure of Wound
2 Open Method

1 **PRIMARY WOUND CLOSURE**—has certain advantages

a) Converts Compound' Fracture into Simple fracture
b) Secondary infection may be avoided
c) Tissue healing occurs within weeks
d) Non adherent scar forms
e) Hospitalization shortened
f) Disability reduced to minimum
g) CONTRAINDICATIONS—to primary wound closure
   1) Wounds over 8 hours old
   2) Extensively contused wounds
   3) Contaminated wounds suspicious of possible gas infection
   4) Inadequate debridement
   5) Tissues under undue tension
   6) Multiple wounds (i e) war wounds

2 **OPEN METHOD**

a) Open all pockets and recesses to establish adequate drainage of pus
b) Wash wound using continuous irrigation with sterile physiological *saline solution*
c) Remove foreign bodies, sequestra and available necrotic tissue
d) Insert plain or petrolatum impregnated gauze into wound and all recesses

C OPERATING ROOM

The patient is transferred to O R as soon as he recovers from shock, and is in condition to withstand movement and manipulation

1 PRELIMINARY SURGERY

a) Sterile precautions are taken by surgeon, assistants and attendants

b) General anesthesia is preferred

c) X-Rays taken immediately

d) Place extremity on leg or arm rest with or without traction and prepare as follows

1) Don't disturb original dressing

2) Wash with sterile soap and water about wound for 10 minutes, shave skin, use benzene to remove grease

3) Remove original dressing from wound

4) Wash wound gently with soap and water for 10 minutes, use cotton pledgets Wound should be irrigated frequently with sterile saline solution

5) Throughout debridement maintain continuous irrigation with sterile physiological saline solution

e) Explore open wound wide enough along anatomical lines to have clear vision of the area of hematoma or soft tissue damage and repair all severed nerves, tendons and blood vessels Bone repair is usually last consideration

f) Reduction of Fracture

1) Unstable position of fragments may require internal fixation

2) Fixation by skeletal pins may be indicated, pins are placed well above and below fracture site and may be incorporated in cast

3) Avoid infection, avoid excess tissue dissection

g) Wound closure

1) *Primary wound closure if possible* Avoid undue tension

2) Use minimum of catgut in wound

3) Use fluff-pressure bandage, if dressings become saturated, change several times during first 24 hours

4) 1 or 2 liters of warm sterile physiological saline solution allowed to run through rubber tubing and glass tip may be used to continuously irrigate wound

5) Do not pour antiseptics into wound Paint area about the wound with antiseptic

6) Redrape surgical field, surgeon and assistants change gown and gloves

2 DEFINITIVE SURGERY

a) Debridement

MANAGEMENT OF HEAD INJURIES

A GENERAL CONSIDERATIONS

An early and correct diagnosis of head injury is most important To administer proper treatment and obtain ideal results in head injuries, one must understand the underlying pathology and the resultant pathological physiology Approximately 10% of head injuries will die despite therapy, about 25% will require surgical interference, while the remaining 65% will recover under adequate conservative management One important basic change that occurs in head injury is **cerebral swelling** Failure to reverse this process of 'cerebral edema —results in ultimate death of the patient Intracranial hemorrhage resulting from trauma, may similarly result in death from **cerebral compression**

If pathogenic organisms invade the wound subdural or cerebral abscess may develop This too, results in increased **cerebral compression** A diagnosis is made when signs and symptoms of increasing *intracranial pressure and meningeal infection become manifest* An early and correct diagnosis of cerebral swelling augmented by timely surgical exploration and evacuation of the clot will lower existing morbidity and mortality

B DIAGNOSIS OF HEAD INJURIES

1 A careful and complete routine **neurological survey** is done on all head injuries

   a) This establishes a **base line** differentiating the immediate injury resulting from the initial trauma from those signs and symptoms that may subsequently result from expanding hemorrhage

   b) Most important is the patient s state of consciousness If the patient comes in conscious—the degree of retrograde amnesia and unconsciousness will be evaluated If the patient enters in a semi comatous or comatous state—a determination of his response to supraorbital pressure will be determined and recorded **Focal** injury or compression of the brain will be manifested by paralytic phenomena progressive hemiparesis unilateral papillary changes

   c) **After a base line has been established—chart all vital signs**

      1) **Increasing unconsciousness** and developing **focal** signs *should serve as more reliable guides* than progressive changes in the temperature pulse and respiration **The latter signs may be "too late"** signs, the former signs should indicate immediate exploratory surgery

e) Apply plaster cast, include joints above and below fracture site
   1) Multiple pin method may be employed for early ambulation by men experienced in its use
f) Serotherapy
   1) Tetanus Anti-Toxin, repeated if necessary
   2) Tetanus Toxoid, (Booster-shot) if patient has been previously vaccinated
   3) Gas bacillus Anti-Toxin, (Polyvalent)
g) Chemotherapy—REMEMBER THAT CHEMOTHERAPEUTIC DRUGS CANNOT OVERCOME THE EFFECTS OF INADEQUATE DEBRIDEMENT
   1) Antibiotics (Local or/and systemic)
      (a) Penicillin
      (b) Chloromycetin
      (c) Bacitracin, etc (See 'Antibiotics)
   2) Sulfonamides
      (a) Sulfadiazine—orally
   3) Dakin's Solution (½ strength)—local irrigations
h) Subsequent wound management
   1) Infrequency of dressings and casts
      (a) Odor alone is no indication for change of cast
      (b) Gas or Tetanus infection indicates a change of dressings and cast
   2) Secondary Wound Closure may be attempted after 1 week
      (a) INDICATION
         (1) When wound is granulating cleanly with minimum suppuration and without sinus formation
      (b) CONTRAINDICATION
         (1) When obvious suppuration exists, 'open method' is treatment of choice

NOTES

D CHEMOTHERAPY—SEROTHERAPY (Employed Prophylactically in Compound Fractures)

1 Antibiotics, (See "Antibiotics")
   a) Local therapy
   b) Systemic therapy
   c) Combined therapy
2 Anti-gas gangrene serum
3 Tetanus Prophylaxis
   a) Anti toxin
   b) Toxoid (Booster shot")

E INDICATIONS FOR SPINAL PUNCTURE

1 Unconsciousness—for 24 hrs or more
2 Convulsive seizures (Jacksonian epilepsy)
3 Marked restlessness
4 Markedly elevated temperature
5 Delayed neurological signs
   a) Dilated pupil
   b) Paralysis of extremity
6 Mental Signs
   a) Disorientation
   b Confusion without restlessness

F TREATMENT OF HEAD INJURY

1 TREATMENT OF SHOCK
   a) Lower head
   b) Keep patient comfortably warm
      1) Heat cradle, hot water bottle, or electric pad
      2) Discontinue external heat when rectal temperature exceeds 100° F
      3) CAUTION Avoid burning the unconscious patient'
   c) ADMINISTER FLUIDS
      1) Avoid large quantities of isotonic fluid, excessive chloride promotes increased cerebral edema
      2) 10% Dextrose in sterile distilled water is mildly hypertonic and therefore aids in reducing tissue edema
      3) Blood plasma or a mixture of blood and plasma, is employed whenever a significant blood loss has occurred
   d) STIMULANTS—may be employed only in marked collapse Blood pressure and circulation must be maintained for proper oxygenation of tissues
      1) Caffeine
      2) Neosynephrine
      3) Adrenalin
      4) Levophed, Aramine or Wyamine
2 POSITION OF PATIENT
   a) Unconscious patient

ORDERS FOR MANAGEMENT OF HEAD INJURIES

A patient with a head injury must be watched carefully and continuously

A Shock must be treated first—it is an immediate threat to life Undue handling may aggravate patient's condition Observe the following PRECAUTIONS

1 Nothing by mouth until ordered
2 Keep patient flat in bed, no pillows Avoid Trendelenberg position because it increases cerebral congestion
3 Absolute quiet is maintained, the patient s chance for recovery may depend on this precaution
4 Do not take X-Rays until ordered by the Surgeon
5 Do not give Morphine to suspected head injuries (depression of respiratory center must be avoided)
6 Do not give hypertonic solutions unless ordered by the Surgeon
7 Do not do spinal puncture unless ordered by the Surgeon

B **The following clinical observations should be noted and charted at regular intervals**

1 Temperature (rectal) q hourly, (q ½ hr in children)
2 Pulse rate quality and variations
3 Respirations rate and variations
4 Blood Pressure readings
5 Involuntary voiding
6 Restlessness
7 State of unconsciousness oriented, delirious, maniacal, semi-comatous comatose or deep coma
8 Pupils size equality and regularity
9 Fluid intake and fluid output
10 Reflexes
   a) Normal
   b) Pathological (i e)
      1) Babinski's sign
      2) Brudzinski's sign
      3) Kernig s sign
      4) Hoffman s sign etc

C **TREAT SCALP WOUND (IF PATIENT'S CONDITION PERMITS)**

1 Shave hair about wound
2 Cleanse skin about the wound with soap and water
3 Prepare skin around wound with a skin antiseptic
4 Debride devitalized tissues
5 Determine the presence or absence of skull fracture
6 Close wound loosely—or leave open depending on the co-existence of skull fracture

nostic significance A blood tinged spinal fluid usually indicates a higher mortality rate than does a clear specimen Frank blood in the spinal fluid raises the mortality rate even still higher

d) DEHYDRATION*

1) Control Fluid Intake
   (a) Maintain fluid intake and 'fluid output", chart
   (b) 1500 2500 cc (5-10%) Dextrose in sterile distilled water q 24 hrs I V
   (c) Oral feedings to conscious patients
   (d) Controlled I V fluids and nasal-tube feedings to stuporous and comatose patients, (2-3000 Cal)
2) 50% glucose—100 cc q 4 hrs as ordered by Surgeon
3) 50% sucrose—100 cc q 4 hrs as ordered by Surgeon
4) Hypertonic plasma
   (a) Especially when a concomitant surgical problem exists, (2 dry plasma containers mixed with 1 liter of sterile distilled water)
5) Magnesium Sulphate—
   (a) 300 cc of concentrated solution given by proctoclysis 60 drops per minute

4 TREATMENT OF ELEVATED TEMPERATURE (HYPERPYREXIA)

a) Temperature over 102° F should be treated as follows
   1) **Reduce garment and covers** to barest minimum
   2) **Ice packs** to axilla groin and axilla
   3) **Fan**—blowing directly on patient
   4) **Rectal**—Acetylsalicylic acid (Aspirin), 10-15 grains

In the course of examining a patient with a head injury the surgeon must be on the lookout for one of the five major types of head injuries that should be treated surgically They are

1) Compound fracture of the skull
2) Depressed fracture
3) Epidural hematoma (middle meningeal artery)
4) Subdural hematoma
5) Intracranial hematoma

*Dehydration treatment has many drawbacks at times it may be carried to the point of harmful dehydration The following disadvantages should be borne in mind
1 Hypertonic glucose often gives rise to a recurrent rise in spinal fluid pressure
2 Hypertonic sucrose gives a lesser recurrent rise in spinal pressure than glucose but it should not be given where renal damage exists
3 While dehydrating patient, one may easily overlook adequate hydration
4 Magnesium sulphate treatment should be avoided where edema exists

1) Do not place unconscious patient on his back!
2) Place patient in lateral position, (Sims) Maintain adequate airway
3) Keep head low to prevent aspiration of mucus or vomitus
4) Meticulous attention to skin, prevention of bladder distention and bowel care are indispensible to proper care of the unconscious patient

b) **CONSCIOUS PATIENT**—(position varies)
1) Shock—lower head below the horizontal plane, level bed when shock is over
2) Consciousness without shock—elevate head of patient
3) Rhinorrhea—sit patient up, gravity assists nasal drainage

3 **TREATMENT OF RESTLESSNESS**

a) ***Physical restraints***—*may be resorted to if patient is maniacal and resists handling*
1) Nursing care
2) Leather cuffs
3) Sides to bed

b) **DRUGS**
1) Paraldehyde—rectally q 3 hrs and P R N
2) Sodium Amytal—I V if patient is uncontrollable
3) Morphine Sulphate—should be avoided in all head injuries In certain brain injuries where hyperpnea occurs with resulting increased loss of CO_2 morphine may be beneficial in depressing respirations

c) **SPINAL PUNCTURE**—may be carried out **after** shock is controlled and the patient has been completely examined Spinal puncture is directed at determining and controlling intracranial pressure
1) Manometric determination is made
   (a) Normal pressure 180 mm H_2O or less
   (b) High pressure 300 mm H_2O or more
2) Moderately increased spinal pressure (240 mm H_2O) is managed conservatively
3) Markedly increased spinal pressure (300 mm H_2O or more) usually indicates surgical intervention
4) To control restlessness due to increased intracranial pressure slowly draw off a sufficient amount of spinal fluid This procedure may be repeated until pressure signs disappear
5) Rule—for lowering spinal fluid pressure subtract normal (180) from elevated reading divide the difference by 2 and lower pressure by that amount
6) Examination of the spinal fluid has diagnostic and prog-

2 Nothing by mouth
3 No morphine or any other narcotic
4 Flat X ray films (Scout)
   a) 3 views, standing, sitting and lateral
   b) Look for shifting free air bubble which is pathognomonic of a ruptured hollow viscus
   c) Check for clear right psoas shadow as compared with left retroperitoneal rupture of duodenum may be recognized
   d) Check for left upper quadrant mass or elevated left diaphragm, spleen may be recognized
   e) I V Pyelogram may reveal kidney injury
5 Record
   a) Rectal temperature hourly
   b) Complete blood count, stat and hourly
   c) Urinalysis, stat and repeat as required
   d) Blood pressure q ½ hour
   e) Pulse rate q ½ hour
6 Watch For
   a) Signs of abdominal rigidity
   b) Signs of abdominal distention
   c) Signs of localized tenderness and rebound tenderness
   d) Signs of shock
7 Check Bowel Sounds For
   a) Hyperperistalsis
   b) Hypoperistalsis
   c) Silent Abdomen'
   d) Borborygmi
8 **Notify surgeon immediately** if any significant change in the above observations occur

E **MANAGEMENT OF BURNS** (See Burns)

F **MANAGEMENT OF HEAD INJURIES** (See 'HEAD INJURIES')

NOTES

ORDERS FOR INJURY AND ACCIDENT CASES

A AT SITE OF ACCIDENT

1 Carefully splint patient where he lies!
2 Carefully transport patient to hospital
3 Carefully cover all wound surfaces
4 Pressure dressings on bleeding wounds
5 Tourniquet is applied whenever bleeding is severe (Release tourniquet every 10 minutes for 1 minute during transit)

B IN THE ADMITTING ROOM

1 Treat patient for shock—stat! Treatment of shock takes precedence over all other considerations
2 Inspect injury for hemorrhage Control hemorrhage by sterile compression dressing, hemostat or tourniquet
3 Look for evidence of fracture, (do not try to elicit crepitation) If a fracture is evident or suspected splint the limb immediately with sand bags, padded metal splint, etc , to protect from further injury until the surgeon arrives
4 Determine presence or absence of head injury
   a) See Management of Head Injuries"
5 Determine presence of vascular, nerve or tendon injury
6 Determine presence or absence of intra-abdominal injury
   a) See Initial Management of Intra Abdominal Injuries"
7 X rays—ordered by surgeon when necessary
8 Give the following prophylactic medication if indicated
   a) Tetanus Anti-Toxin—3000 5000 units (Check on sensitivity to horse-serum)
   b) Tetanus Toxoid— Booster-shot (0 5 cc) given if patient was previously actively immunized against tetanus Surgeon may decide to employ both

C IN THE OPERATING ROOM

Injuries such as lacerations crushing accidents and compound fractures usually require debridement or suturing, they are best prepared in the Operating Room

1 Have necessary padded splints ready for immediate use
2 Cleanse skin **around** the wound
   a) Benzene is used first if wound is greasy or grimy
   b) Prep with sterile soap and water for 10 minutes
   c) Rinse with a continuous flow of sterile water or physiological saline solution this can be done by simply using an I V flask, rubber tubing and plastic tip
3 Do not shave or prep skin in fracture cases where skin is not broken The cast is applied over the unprepared skin

D MANAGEMENT OF SUSPECTED INTRA ABDOMINAL INJURIES

1 Absolute bed rest

Antitoxin in divided doses, (have 1 1000 Epinephrine (Adrenalin) ready at all times, Bovine-Tetanus Antitoxin may be employed)

3 If the patient received Tetanus Toxoid within 2 years prior to his injury, a booster dose of 0 5 cc of Tetanus Toxoid, (I M) given soon after the injury will suffice

B ACTIVE

1 SPECIFIC THERAPY

a) 80 000 units of Tetanus-Antitoxin given stat (This dose does not have to be repeated)

40,000 units **intramuscularly**

40,000 units **intravenously** in 200 cc Physiological Saline to which has been added 0 5 cc of 1 1000 Adrenalin, (Epinephrine)

b) If skin test shows positive, additional Adrenalin (1 cc) may be required Bovine-Tetanus-Antitoxin may be employed instead

2 SEDATION THERAPY

a) **Phenobarbital** (Nembutal or Seconal, orally or rectally)

b) **Sodium Amytal** (sodium isoamylethyl barbiturate), 3 to 5 gr intravenously, to relax glottal spasm or relieve convulsions

c) **Avertin** (Tribromoethanol amylene hydrate) is given rectally in severe convulsions (Dose 35-50 mgs per kgm body weight q 4 to 6 hrs)

3 ANTIBIOTIC THERAPY

a) Penicillin, 300,000 units intramuscularly, twice daily, or 400,000 units (aqueous penicillin) in each liter of intravenous fluids

1) The effect of Penicillin on *Clostridium tetani* is still doubtful, however, pulmonary complications and secondary infections are prevented or minimized by its employment

4 SURGICAL CONSIDERATIONS

a) **Surgical Treatment of the Wound**

1) Local surgical treatment is often necessary

2) If wound must be incised for drainage it must be wide enough to establish an aerobic environment Oxygen liberation solutions may be applied as wet dressings Zinc peroxide paste or solution is an excellent agent

3) **CAUTERIZATION OF THE WOUND SHOULD BE AVOIDED!** (Necrotic tissue favors the growth of *Clostridium tetani*)

4) Never attempt a procedure unless the patient is adequately relaxed with sedation drugs

5) Foreign bodies must be searched for and removed

5 TRACHEOTOMY

Emergency tracheotomy is indicated where prolonged dysphagia

TETANUS

BY

ABRAHAM LEVINSON, M D *

Chief of Staff of Children s Division Cook County Hospital Sr Attending Pediatrician Mt Sinai Hospital Chicago Illinois Professor of Dept of Pediatrics Northwestern University Medical School Professor of Pediatrics at Cook County Post Graduate School Head of 'Tetanus Team Cook County Hospital Chicago Illinois

and

CHARLES GOLDENBERG, M D

Associate Pediatrician Dept of Pediatrics Cook County Hospital Clinical Instructor Dept of Pediatrics at Northwestern University Medical School Asst Attending Dept of Pediatrics Michael Reese Hospital Chicago Illinois

Tetanus may occur as a result of contamination in compound fractures burns, frostbites, gangrene, abortions splinters and minor injuries The disease is uniformly fatal when left untreated Death may occur after repeated convulsions, asphyxia (secondary to prolonged glottal spasm) or from hypostatic pneumonia

DIAGNOSIS

A diagnosis of Tetanus is established when any combination or all of the following signs are recognized

1 Rigidity of the neck
2 Trismus and risus sardonicus
3 Rigidity of the abdominal muscles
4 Arching of the back (Opisthotonus)
5 Convulsions
6 Glottal spasms
7 Profuse perspirations
8 Temperature (low grade fever may exist when not complicated by secondary infection)

   The sensorium remains lucid in most cases

   Spinal puncture is contraindicated when tetanus is suspected because the needle may break off as a result of muscle spasm

TREATMENT

A PROPHYLACTIC

1 A routine minimum of 5 000 units of Tetanus-Antitoxin is given intramuscularly
2 In contaminated wounds 10 000 units of Tetanus-Antitoxin should be administered
   a) Intradermal skin test should be done routinely for sensitivity to horse serum (0 1 cc of 1 100 dilution with saline injected intradermally)
   b) If a positive reaction to the skin test results give Tetanus

*Died—1955

ORDERS FOR MANAGEMENT OF DELIRIUM TREMENS

DELIRIUM TREMENS—is an acute transient psychosis often observed in chronic alcoholics It is characterized by visual hallucination, (during which a person so afflicted develops a marked fear of the objects seen), and disorientation for time and place The **HISTORY** usually reveals that the patient with D T s" has recently engaged in a heavy alcoholic debauch (drinking more than eating), and has suffered from prolonged periods of sleeplessness A nutritional deficiency develops in which the loss of Vitamin B_1 is the most likely factor Habitual drinkers when suddenly cut off from their regular consumption of alcohol may develop ' D T 's"

This form of alcoholic psychosis lasts from 2 to 10 days and commonly terminates with a prolonged and profound sleep The mortality varies from 5 to 15% Heart failure and pneumonia are common causes of death

PRECIPITATING FACTORS ARE

1 Infection
2 Trauma
3 Cardiac decompensation
4 Diabetes Mellitus

TREATMENT OF DELIRIUM TREMENS

There is no specific therapeutic measure The important considerations are

1 Sedation
2 Rest and
3 Maintainance of nutrition

A **PROPHYLACTIC MEASURES**

Immediately after the appearance of **premonitory signs,** (i e, **irritability, profuse perspiration, aversion to food, euphoria and sleeplessness,** transfer the patient to a private room, and **ORDER** the following

1 Bed rest
2 Male attendant
3 S S Enema stat, unless contra-indicated by *intraabdominal* injury or inflammation
4 Drugs
   a) **Morphine sulphate—CONTRA-INDICATED!**
   b) **Paraldehyde**—1 drachm hourly until patient is quiet or asleep Paraldehyde may be given I M **(CAUTION DO NOT GIVE I V !)**
   c) Sodium Amytal—0 5-1 Gm (I V) daily
   d) **Serpasil and Sparine**
   e) **Chloral Hydrate**—15-30 grains B I D

or severe glottal spasm develop Tracheostomy prevents aspiration pheumonia and establishes a free airway **A TRACHFOSTOMY SET MUST BE AT PATIENT'S BEDSIDE AT ALL TIMES!**

6 NURSING CARE

a) A team of trained nurses is most important! **THE PATIENT MUST NEVER BE LEFT ALONE WITHOUT SUPERVISION**

b) A darkened, quiet room is an ideal environment No visitors are allowed

c) Frequent changes of position will prevent decubital ulcers and pulmonary complications

d) Routine periodic nasal and pharyngeal suction is most important

e) Trendelenberg position when dysphagia occurs, will prevent aspiration pneumonia

f) I V fluids with multi-vitamins is desirable

g) A board placed under the mattress may prevent injury to the spine

h) Oral feedings are instituted when convulsions subside and no dysphagia exists

7 FOLLOW-UP CARE

a) X-ray of the entire spinal column should be taken before the patient is allowed to sit or walk Compression fractures of the vertebrae not infrequently develop during severe spasms of the back musculature

b) Active immunization should be started not later than one month after complete recovery 0 5 cc Tetanus Toxoid at one month intervals for two doses and 0 5 cc annually thereafter

NOTES

ORDERS FOR MANAGEMENT OF DELIRIUM TREMENS

DELIRIUM TREMENS—is an acute transient psychosis often observed in chronic alcoholics It is characterized by visual hallucination, (during which a person so afflicted develops a marked fear of the objects seen), and disorientation for time and place The **HISTORY** usually reveals that the patient with D T's" has recently engaged in a heavy alcoholic debauch (drinking more than eating), and has suffered from prolonged periods of sleeplessness A nutritional deficiency develops in which the loss of Vitamin B_1 is the most likely factor Habitual drinkers when suddenly cut off from their regular consumption of alcohol may develop "D T's"

This form of alcoholic psychosis lasts from 2 to 10 days and commonly terminates with a prolonged and profound sleep The mortality varies from 5 to 15% Heart failure and pneumonia are common causes of death

PRECIPITATING FACTORS ARE

1 Infection
2 Trauma
3 Cardiac decompensation
4 Diabetes Mellitus

TREATMENT OF DELIRIUM TREMENS

There is no specific therapeutic measure The important considerations are

1 Sedation
2 Rest and
3 Maintainance of nutrition

A **PROPHYLACTIC MEASURES**

Immediately after the appearance of **premonitory signs,** (i e **irritability, profuse perspiration, aversion to food, euphoria and** sleeplessness, transfer the patient to a private room, and **ORDER** the following

1 Bed rest
2 Male attendant
3 S S Enema, stat unless contra indicated by intraabdominal injury or inflammation
4 Drugs
   a) **Morphine sulphate—CONTRA-INDICATED!**
   b) **Paraldehyde**—1 drachm hourly, until patient is quiet or asleep Paraldehyde may be given I M **(CAUTION DO** NOT GIVE I V !)
   c) Sodium Amytal—0 5-1 Gm (I V) daily
   d) **Serpasil and Sparine**
   e) **Chloral Hydrate**—15-30 grains B I D

- f) **Barbiturates**—may be of value
- g) **Levophed—I V, or Wyamine**—I M or **Aramine** I V or I M, may be employed when circulatory collapse develops
- h) **Vitamins**
  - 1) Nicotinamide—50-100 mg I V daily
  - 2) Thiamin Chloride—150-300 mg I V daily
  - 3) Vitamin B-Complex
    - (a) Solu-B—1 ampoule in 500 cc 5% Dextrose in water I V

5 **Cathartics**
- a) **Epsom Salts**—1 oz q A M before breakfast

6 **Hydrotherapy**
- a) Warm baths may be of value
- b) Massage is helpful

7 **Diet**
- a) Nourishing and preferably liquid
- b) High protein high carbohydrate, high vitamin, high caloric
- c) A glassful of milk or orange juice to which has been added ½ oz. glucose or dexin
- d) Repeat feedings q hourly

B ACTIVE TREATMENT*

1 Bed rest

2 Male nurse
- a) Vigilance must be maintained constantly
- b) Order restraints and apply them early
- c) Do not struggle with patient, the restraint method is preferred

3 **Drugs**
- a) See drugs listed under **Prophylactic and Active Management.**

4 **Withdraw alcohol abruptly'**

5 Phenobarbital / Dilantin sodium } *(1½)* grains *(ORALLY)*
- a) Sedative and anticonvulsive action
- b) May be ordered q 2 hrs P R N

6 Mephenesin—7½—15 grains (ORALLY) t i d
- a) Skeletal muscle relaxant

7 1-2 liters of 5% or 10% Dextrose in Physiological Saline Solution, I V
- a) May add 100-200 mg of **Thiamine Chloride** with 20-25 units of **Regular Insulin.**

8 Sedation (drugs) may be continued for several days

9 **ACTH**—25 mg in 1 liter 5% Dextrose in water, I V

*Seliger R.V Jour of Nerv and Mental Dis 115 146 1952

a) ACTH—Adrenocorticotrophic hormone may at times effect a dramatic recovery
b) *The adrenal cortical hormone is believed to eliminate the* drying-out period" in acute alcoholism and lessen the craving for alcohol

10 Individualized Psychotherapy and Rehabilitation
11 Diet—(See PROPHYLACTIC MANAGEMENT), in addition ORDER)
   a) Adequate fluid intake to prevent dehydration and acidosis
      1) 500 cc 1/6 M Sodium Lactate
      2) 500 cc Physiological Saline Solution
   b) Concentrated liquid feedings, high caloric, high vitamin, high protein, and high carbohydrate The food should be easily digestible because gastritis is frequently present
   c) Yeast may be added to feedings
12 Spinal puncture—may be done whenever spinal pressure becomes elevated
   a) 15-30 cc spinal fluid may be withdrawn q 48 hours, if acute delirium continues
13 Treat all concomitant lesions simultaneously
14 **In the recovery phase, the patient is treated for chronic alcoholism** The prognosis is usually good, unless intercurrent infection complicates the picture

NOTES

PRE- AND POSTOPERATIVE ORDERS FOR (ONE AND TWO-STAGE ADRENALECTOMY)

BY

JOHN J FARRELL, M D , F A C S

Professor and Chairman of the Department of Surgery University of Miami School of Medicine and Chief of Staff at Jackson Memorial Hospital Miami Florida Director of Surgery at Veterans and Dade County Hospitals

ANATOMICAL CLASSIFICATION OF ADRENAL LESIONS

A ADRENAL MEDULLARY TUMORS (Hyperplasia is unknown)
- 1 Secretory
  - a) Pheochromocytoma
- 2 Non-Secretory
  - a) Neuroblastoma
  - b) Ganglioneuroma

B ADRENAL CORTICAL LESIONS
- 1 Hyperplasia
  - a) Cushing s Syndrome
  - b) Congenital Virilism
- 2 Tumor
  - a) Cushing s Syndrome
  - b) Virilizing Syndrome
  - c) Feminizing Syndrome
  - d) Primary Aldosteronism
  - e) Mixed and Intermediate Syndromes

I ADRENAL MEDULLARY TUMORS

A PHEOCHROMOCYTOMA (SECRETORY)

1 PHYSIOLOGY AND ETIOLOGY

a) Pheochromocytoma secretes excessive epinephrine and norepinephrine in variable proportions, intermittently or continuously This syndrome is always due to a tumor of pheochrome tissue, (hyperplastic tissue is unknown)

2 MANIFESTATIONS

a) Arterial hypertension clinically indistinguishable from essential hypertension

b) Paroxysmal attacks of nervousness tachycardia, hypertension headache, nausea and choking suggesting anxiety attacks

c) Mixed clinical patterns

3 DIAGNOSTIC AIDS

a) Urinary catechol excretion

b) Radiography presacral air insufflation with pyelography and laminography

c) Blood sugar may be elevated and glucose tolerance may be impaired

d) Basal metabolism may be markedly elevated

4 SPECIAL TESTS—Helpful but not 100% reliable
  a) Adrenolytic agents may be useful when blood pressure is persistently elevated
  b) Provocative tests may be useful when attacks are intermittent
    1) Histamine, tetraethyl ammonium chloride
    2) Provocative tests are potentially dangerous! Adrenalytic agents must be on hand to control acute hypertension

5 TREATMENT—Surgery (Excision of Tumor)
  a) Right adrenal gland involved almost twice as often as left Such tumors may also develop in all extra adrenal sites of embryonic placed pheochrome tissue
  b) Adrenolytic agents are necessary to control sudden elevations of blood pressure while the tumor is manipulated during surgery
  c) Norepinephrine is often required to maintain blood pressure after the tumor is removed
  d) Results of surgery are usually excellent, but relief of hypertension may require months

B NEUROBLASTOMA—(Non-secretory)
  1 Common retroperitoneal tumor of early childhood It is highly malignant
  2 Preoperatively neuroblastoma cannot be distinguished from embryoma of kidney

C GANGLIONEUROMA (Non-secretory)
  1 A slow growing tumor of mature cells, prognosis is favorable
  2 Treatment—Surgical may follow with deep X-ray therapy

II ADRENAL CORTICAL LESIONS

A CUSHING'S SYNDROME
  1 DIRECTLY DUE TO EXCESS 17 HYDROXYCORTICOID SECRETION
    a) Bilateral adrenal cortical hyperfunction
      1) 80% adults
      2) Primary cause is probably excess ACTH secretion by pituitary gland
    b) Adenoma
      15% adults
    c) Carcinoma
      5% adults
      Preponderant cause of the syndrome in children
  2 CLINICAL FEATURES
    a) Typical Habitus
      1) Central (truncal) obesity
      2) Moon face
      3) Cervico-dorsal fat pad

4) Kyphosis

b) **Integumentary changes**

1) Florid face, mottled, cyanotic legs, seborrhea, acne (facial), purple striae, hirsutism, (chiefly facial) *

c) **Hypogonadism**

1) Amenorrhea in females

2) Impotence in males

d) **Diabetes**

1) Overt or latent (impaired glucose tolerance)

e) Hypertension

f) Osteoporosis

g) Emotional disturbances

h) Edema (usually slight)

3 **RADIOGRAPHIC FEATURES**

a) **Skull—seldom** shows pituitary tumor

b) Osteoporosis—generalized, especially spine, wedge deformities of vertebrae seen in advanced cases

c) Presacral air injection (often misleading)**

4 **LABORATORY FEATURES** (NOT DIAGNOSTIC)

a) Urinary 17-ketosteroid excretion low, normal or high

b) Urinary 17-hydroxycorticoid excretion—usually elevated

c) Plasma 17-hydroxycorticoid concentration—usually elevated

d) Circulating eosinophils—low (below 50 per mm^3)

e) Erythrocyte and total leukocyte count—may be high

f) Urine—alkaline

g) Serum CO_2—High (alkalosis)
Cl—Low
K—Low

*Hirsutism per se as the only sign is not of diagnostic importance

**Presacral air insufflation is best carried out in combination with I V Pyelography and laminography

5 MANAGEMENT
- a) Treatment of choice—surgery
  - 1) Tumor is excised (except where metastasis exists)
  - 2) Bilateral hyperplasia is treated with bilateral, subtotal or total adrenalectomy
  - 3) X radiation to pituitary gland is rarely employed, and only after a thorough study to rule out tumor
- b) Methods of differentiation, (Tumor vs Hyperplasia)
  - 1) **Radiographic studies may demonstrate tumor**
    - (a) Intravenous pyelogram
    - (b) Presacral air injection
    - (c) Laminography
  - 2) **Physiologic Laboratory Studies**
    - (a) Urinary 17 ketosteroids—above 50 mg /24 hrs indicates adrenal cortical carcinoma
    - (b) Response of urinary steroid excretion (17-ketosteroids and 17-hydroxycorticoids) to administration of 20U ACTH I V over 8 hour period
      - (1) Marked response—Bilateral Hyperplasia
      - (2) No response—cortical carcinoma
      - (3) Adenomas—little or no response

6 **RESULTS OF SURGICAL TREATMENT** (Remission is the rule—unless metastases are present)
- a) **Adenoma**—opposite adrenal atrophic, but will resume function Cortisone and ACTH needed initially only
- b) **Bilateral Adrenal Hyperfunction**
  - 1) **Total Adrenalectomy**—cortisone replacement therapy must be permanent
  - 2) **Subtotal Adrenalectomy**—Cortisone replacement therapy may or may not be permanently required (Disadvantage of subtotal resection is possible incomplete remission or recurrence)
  - 3) WHATEVER THE ADRENAL LESION THE POST OPERATIVE COURSE MAY BE STORMY
  - 4) LARGE QUANTITY OF CORTISONE IS REQUIRED INITIALLY CORTISONE WITHDRAWAL MAY REQUIRE A MINIMUM OF 6 TO 12 MONTHS
  - 5) BEWARE OF THE LOW-POTASSIUM SYNDROME DURING THE POSTOPERATIVE PERIOD

B VIRILIZING SYNDROME (Classification)

1 **Congenital**—always due to bilateral cortical hyperplasia
2 **Adolescence and Postadolescence in females** Often due to bilateral cortical hyperfunction even when 'oyster ovaries are present
3 **After neonatal period in childhood**—due to adrenal cortical tumor, usually malignant
4 **Adults**—Adrenal cortical tumor, usually malignant

CONGENITAL VIRILISM

a) **Pathologic Physiology**—Enzymatic defect of cortex, androgenic (inadequately oxygenated) steroids produced instead of hydrocortisone Lack of hydrocortisone leads to overproduction of ACTH, adrenal hyperplasia and more intense androgenic activity of cortex

b) **Manifestations**

Girls

1) Masculinization of external genitalia at birth
2) Progressive virilization

Boys

1) Precocious Pseudopuberty } Onset usually 3 months
2) Enlarging phallus } to four years of age
3) Secondary sex characteristics
4) Small testes with no spermatogenesis

Boys and Girls

1) Initial manifestation may be **acute adrenal insufficiency**

c) **Treatment**—Cortisone hydrocortisone or cortisone derivatives

1) **Acquired Virilism**—(Virilizing syndrome in young women) Similar in patho-physiology to congenital virilism **Cortisone** and related compounds reduce elevated urinary 17-ketosteroids to normal—and are the therapeutic agents of choice
2) **Virilizing Tumor**
Treatment—Surgical removal

C FEMINIZING SYNDROME

1 **Manifestations**

a) Male—gynecomastia sometimes hypogonadism
b) Female—not described
c) Always due to benign or malignant tumor

2 **Treatment**

Surgical excision of tumor

D PRIMARY ALDOSTERONISM

Described as an entity by Jerome Conn, M.D in 1955 * Over 50 cases have been reported to date, usually as adenomas; at times as carcinoma, rarely as bilateral cortical hyperfunction.

1 Manifestations
   a) Hypernatremia
   b) Hypokalemic alkalosis with tetany
   c) Muscular weakness (Mild to severe)
   d) Hypertension
   e) Polyuria and polydipsia
   f) Normal levels of urinary 17-ketosteroids and 17-hydroxycorticoids
   g) Increased levels of urinary "aldosterone"
2 Treatment—Surgical excision of tumor

E MIXED AND INTERMEDIATE SYNDROMES

1 Adrenal cortical tumors especially carcinomas, may give rise to clinical syndromes with bizarre combinations of feminizing masculinizing Cushing or aldosterone-like features

*1 Conn J W—Primary Aldosteronism, New Clinical Syndrome J Lab and Clin. Med. 45 6-17 1955
2. Conn, J W—and Louis, L H—Primary Aldosteronism New Clinical Syndrome Ann. Int. Med. 44 1 15 1956

NOTES

INDICATIONS FOR PALLIATIVE ADRENALECTOMY

1 **PALLIATIVE BILATERAL TOTAL/OR SUBTOTAL ADRENALECTOMY (1 OR 2 STAGES) PERFORMED FOR**
- A Malignant Hypertension (Not amenable to medical therapy)
- B Chronic Hypertension (with organic changes)
  - 1 Rarely is adrenalectomy indicated in A) and B)
- C Breast Carcinoma, with bony metastasis
- D Prostatic Carcinoma, with bony metastasis

} Bilateral total adrenalectomy

II **UNILATERAL (1st STAGE) TOTAL ADRENALECTOMY**—Does not require any special care—other than the usual operative precautions and routine pre- and postoperative care (See "Laparotomy Orders")

III **BILATERAL (2nd STAGE) SUBTOTAL ADRENALECTOMY**—requires special considerations in addition to routine pre- and post-operative care **Cortisone** and **Norepinephrine** (Levophed) are invaluable aids during and after surgery

ADRENAL SURGERY—has emerged from its hazardous evolutionary phase to become a relatively safe and practical reality if postoperative management and after care is meticulous Allied fields of science have contributed the following invaluable aids to adrenal surgery—without which adrenal surgery could not have advanced

1 **CORTISONE, HYDROCORTISONE AND RELATED STEROIDS**
- a) Maintain life in absence of adrenal glands
- b) Employed after excision of adrenocortical tumors

2 **BENZODIOXAN, REGITINE AND DIBENAMINE**
- a) Adrenolytic agents that block action of epinephrine and norepinephrine
- b) Employed during surgery for excision of pheochromocytoma prevents or controls sudden B P elevations

3 **NOREPINEPHRINE (LEVOPHED)**
- a) An effective vasopressor
- b) Employed during and after surgery to sustain normal B P levels

I **PRE-OPERATIVE ORDERS FOR PALLIATIVE ADRENALECTOMY** (Breast and Prostate Gland Carcinomatosis)

A **WORKUP**

1 Complete blood count
- a) If **Hemoglobin** is less than 11 0 Gms or/and R B C s are less than 3 500 000 cu/mm transfuse patient **stat**

2 Urinalysis

3 Wassermann or Kahn

4 Type and cross-match blood, hold 2 units of blood in bank, have donors standing by
5 X-rays—as ordered by Surgeon
6 **Blood Chemistry**—(on fasting stomach)
 a) Cephalin-Flocculation
 b) Bromsulphalein
 c) Prothrombin Time
 d) N P N or Creatinine
 e) Serum Sodium, Potassium and Chloride
 f) A/B Ratio
 g) Serum calcium

 NOTE 1) Electrolytic deficits should be corrected preoperatively—especially potassium, ($K+$)
 2) Protein deficit (hypoproteinemia), requires too long a period for correction Normal Human Albumin (salt-free), blood and plasma transfusions all help to improve total circulating protein but they do little to correct the generalized protein deficiency of the tissues It appears wiser to go ahead with the adrenalectomy and thereby remove the cause of excessive protein catabolism—than to unduly prolong the preoperative period

B MEDICATION
1 **Depo Cortisone Acetate**
 a) 300 mg I M 12 hours before surgery
2 Nembutal gr 1½ at bedtime
3 Analgesics—for pain of bony metastasis
4 Ascorbic Acid—500-1000 mg/daily to correct Vitamin C deficiency
5 Demerol—50 to 100 mg } 1 hr before surgery
 Scopolamine gr 1/150* }

C MANAGEMENT
1 Up and around privileges
2 General diet
3 **Night before surgery**
 a) N P O after 7 P M except water· no water after midnight
 b) 2 qt. S S Enema—at 9 P M
 c) Prep—Abdomino-perineal, (from nipples to mid-thighs)
4 **Morning of Surgery, 7 A.M**
 a) Levin-Wangensteen suction (use No 16-18F Tube) Patient goes to surgery with tube indwelling

INDICATIONS FOR PALLIATIVE ADRENALECTOMY

1 PALLIATIVE BILATERAL TOTAL/OR SUBTOTAL ADRENALECTOMY (1 OR 2 STAGES)
PERFORMED FOR
- A Malignant Hypertension (Not amenable to medical therapy)
- B Chronic Hypertension (with organic changes)
  - 1 Rarely is adrenalectomy indicated in A) and B)
- C Breast Carcinoma, with bony metastasis
- D Prostatic Carcinoma, with bony metastasis

} Bilateral total adrenalectomy

II UNILATERAL (1st STAGE) TOTAL ADRENALECTOMY—Does not require any special care—other than the usual operative precautions and routine pre- and postoperative care (See "Laparotomy Orders ')

III BILATERAL (2nd STAGE) SUBTOTAL ADRENALECTOMY —requires special considerations in addition to routine pre- and post-operative care **Cortisone** and **Norepinephrine** (Levophed) are invaluable aids during and after surgery

ADRENAL SURGERY—has emerged from its hazardous evolutionary phase to become a relatively safe and practical reality if postoperative management and after care is meticulous Allied fields of science have contributed the following invaluable aids to adrenal surgery—without which adrenal surgery could not have advanced

1 CORTISONE, HYDROCORTISONE AND RELATED STEROIDS
- a) Maintain life in absence of adrenal glands
- b) Employed after excision of adrenocortical tumors

2 BENZODIOXAN, REGITINE AND DIBENAMINE
- a) Adrenolytic agents that block action of epinephrine and norepinephrine
- b) Employed during surgery for excision of pheochromocytoma prevents or controls sudden B P elevations

3 NOREPINEPHRINE (LEVOPHED)
- a) An effective vasopressor
- b) Employed during and after surgery to sustain normal B P levels

I PRE-OPERATIVE ORDERS FOR PALLIATIVE ADRENALECTOMY (Breast and Prostate Gland Carcinomatosis)

A WORKUP
1 Complete blood count
- a) If **Hemoglobin** is less than 11 0 Gms or/and R B C s are less than 3 500 000 cu/mm , transfuse patient, stat

2 Urinalysis
3 Wassermann or Kahn

B MEDICATION

1 Demerol—75 mg
Phenergan—25 mg } q 4 hrs P R N for Pain

2 Antibiotic—on order of Surgeon

3 Cortisone Acetate—200 mg I M daily for 2 or 3 days, thereafter—Oral Cortisone—50 mg q 8-12 hrs The dosage of oral Cortisone is gradually reduced to 50 mg /daily—but it may also have to be increased whenever the patient appears to be under stress **The patient's mood and strength should appear good**

a) The maintenance dosage of Cortisone will depend upon the procedure performed, (Subtotal or Total Adrenalectomy), **Total Adrenalectomy** implies complete adrenocortical replacement for duration of patient s life

4 **Desoxycorticosterone (DOCA)** is rarely used today in those few patients with poor renal function who may do better after Cortisone is supplemented by 2-4 mg DOCA, bucally daily or by implantation under the skin of 1-2 (75 gr) pellets

5 **Phenobarbital**—gr 1 (hypo) q P M

6 **Have** Neosynephrine and/or I V /Hydrocortisone available in patient s room

7 **Have Norepinephrine (Levophed)** in patient's room,

a) **Use only as last resort**

C FOLLOW-UP LAB

1 C B C —at 6 P M stat on day of surgery

2 Urinalysis—1st P O day

IV PRE- AND POSTOPERATIVE ORDERS FOR ADRENALECTOMY IN PHEOCHROMOCYTOMA

IN ADDITION TO REGULAR ORDERS LISTED UNDER PRE- AND POSTOPERATIVE ORDERS FOR PALLIATIVE ADRENALECTOMY—ADD

A PREOPERATIVE WORKUP

1 **C B C** —stat, if Hemoglobin is less than 11 Gms or/and if R B C 's less than 3 500 000—transfuse patient stat

2 Type and Cross match—and hold (4) units of blood in bank, have compatible donors stand by

3 **Determination of urinary catechol amines** is a most accurate test Pheochromocytoma secretes catechols in great amounts —in excess of essential hypertension

4 **X ray Studies**

a) Presacral Air Insufflation

b) Peri renal (retroperitoneal) Air Insufflation

c) I V Pyelograms

d) Aortograms

II IN OPERATING ROOM (Procedure)

A At onset of anesthesia—administer

1 **Hydrocortisone I V** by slow drip, 100 mg over a 6 hour period)

B **After anesthesia induction**

1 Hypotension and rapid pulse rate may develop, this usually indicates an unsuspected chronic or borderline shock based on decreased circulating volume

a) Blood plasma or human albumin (salt-poor) may be indicated

2 **Hypotension and rapid pulse rate**—may be difficult to differentiate at onset of surgery—especially if lesion is secreting tumor i e Pheochromocytoma or adrenocortical tumor producing Cushing's Syndrome

3 **Blood loss or 'Cyclopropane Shock'** is an induced hypotension that usually responds to **Neosynephrine** (5 mg /1000 cc 5% Dextrose in water), if after 100 cc of I V infusion B P has not returned to normal—suspect adrenal insufficiency, and accelerate hydrocortisone infusion

III POSTOPERATIVE ORDERS FOR PALLIATIVE ADRENAL ECTOMY

A MANAGEMENT

1 Check B P Pulse and respirations q 10 min until stabilized, then q ½ hr 4x then q 1 hr 4x continue q 1 hourly for 48 hrs thereafter q 3 hrs Keep careful record and chart Special nursing care around the clock is mandatory

2 Encourage deep breathing, turning side to side coughing and kicking q hourly

3 **Levin Wangensteen suction—continuous**

a) Check tubing connections socket, etc

b) Use 50 cc syringe to clean tube q 1 hr

4 **I V FLUIDS**—(2500-3000 cc /daily)

a) 1st Liter—5% dextrose/water, **plus**

1) Vitamins B } 1 Amp Solu-B
C } 500 mg Vitamin C
K } Mephyton (Vitamin K_1)—25-50 mg

b) 2nd Liter—5% Dextrose/water **plus**

1) 500 mg Terramycin (on order of Surgeon)

c) 3rd Liter—5% Dextrose/water plus

1) 40 mEq/L —KCl (3 Gms)

5 Catheterize—q 8 to 10 hrs P R N

6 Rectal tube q i d —for ½ hr

7 Early ambulation is important

- (i) False Positive Reactions—due to
  - (1) Sedatives, narcotics and vasopressor drugs given before test
- (j) Late rise of B P (after 4 to 5 minutes), accompanied by headache—does not indicate medullary tumor

C BLOCKING TESTS

1 Indicated in patients with sustained hypertension of 170/110 or over; (not helpful in lower B P's as in paroxysmal hypertension)

2 Blocking Test depends upon
- a) Specific adrenergic blocking action on epinephrine, norepinephrine and related substances
- b) Agents used to inhibit or block the catachol amines (epinephrine and norepinephrine) are
  - 1) *Regitine (phenolamine-methanesulfonate—(Ciba)*
  - 2) Piperoxan hydrochloride—(Benzodioxan or Benodaine)
  - 3) Dibenamine

3 **Regitine Test**
- a) Same physical set up as under **Histamine—Cold pressor Test**
- b) **Regitine**—5 mg in 1 cc solution is injected I V B P's recorded q 30 seconds for 3 minutes, B P's recorded q 1 minute for 5 minutes
- c) **Postitive Reaction**—is a drop in B P within 2 minutes, a *drop of 30-40 mm Hg systolic and 20-30 diastolic,* or hypertensive B P dropping to normotensive (140/90)
- d) **False positive**—may be due to
  - 1) Sedation, uremia and hypotensive drugs
  - 2) **False positives should be checked with Benzodioxan**
- e) **Avoid overdosage of Regitine—**
  - 1) A peripheral sympatholytic reaction may develop—with marked fall in B P

D *IN OPERATING ROOM*

1 **TWO SUPPORTIVE DRUGS MUST BE ON HAND FOR IMMEDIATE USE**
- a) **Regitine (Adrenergic Blocking Agent)** This drug counteracts hypertensive paroxysms during surgery
- b) **Norepinephrine (Levophed)** This drug sustains and corrects *sudden drop in B P*

2 **Blood Transfusion**
- a) On order of Surgeon

E *POSTOPERATIVE MANAGEMENT*

1 Check B P Pulse and Respirations q 3 to 5 minutes until

5 Fasting Blood Sugar

6 **PHARMACOLOGIC TESTS**

(2 types, (1) Provocative or Pressor, and (2) Blocking or Depressor)

a) **All Extrinsic Influences must be eliminated**
   1) Discontinue all hypotensive and narcotic drugs for 24 hrs preceding tests
   2) Continue with essential drugs, i e Digitalis Insulin, etc

b) **Provocative or Pressor Tests**
   1) **Indicated in 3 groups of patients**
      (a) Undiagnosed spells or attacks of hypertension
      (b) Paroxysmal hypertension
      (c) Sustained B P of 170 mm Hg systolic and 110 mm Hg diastolic *
   2) **Provocative or pressor tests depend upon**
      (a) Sudden release of pressor substances with increase in B P and precipitation of attack
      (b) Substances used to stimulate medullary tumors are
         1 Histamine
         2 Tetraethylammonium chloride
         3 Etamon (TEAB, TEAC)
         4 Methacholine (Mecholyl)
         5 Acetyl B-methylcholine
   3) **Coldpressor—Histamine Test, (Most reliable)**
      (a) Patient is in bed, supine position
      (b) Room darkened for 20 minutes
      (c) Repeat B P readings at 5 minute intervals—until basal level is established
      (d) Immerse one hand in ice water up to wrist—at 4-5° C for 1 minute
      (e) Check B P q 30 seconds for maximal rise Check B P q 5 minutes for return to basal level
      (f) **Histamine Base** 0 025 to 0 05 mg in 1 cc solution—is injected I V
      (g) Check B P q 30 seconds for 5 minutes Check B P q 1 minute for 10 minutes
      (h) **Positive Reaction**—When B P rises (within 2 minutes after injection)—to higher level obtained with cold pressor test

*1) Gifford, R. W Jr., Roth G M and Kvale W F — Evaluation of New Adrenolytic Drug, Regitine (R) As Test for Pheochromocytoma J A M.A., 194 1628 1633 Aug. 30 1952

2.) Sprague R G., Kvale W F and Priestley J T — Management of Certain Hyperfunctioning Lesions of the Adrenal Cortex and Medulla" J A M.A. 151 629-639 (Feb) 1953

on normal adrenal cortex Therefore ACTH stimulation is not required before discontinuing postoperative Cortisone

F Adrenalectomized patients ordinarily have permanent adrenal deficiency and will have to be furnished all the safeguards required in treating Addisonians

NOTES

stabilized, then q ½ hr 6x, then q 1 hr 6x, thereafter q 3 hrs around clock

SPECIAL NURSE MUST NOT LEAVE PATIENT FOR A MOMENT—UNLESS COVERED BY ANOTHER NURSE

2 Have Norepinephrine (Levophed) in room, have (2) ampoules dissolved in 1 liter 5% Dextrose in Water, have "Levophed bottle" hanging with I V needle inserted into rubber collar behind regular I V needle, ready to use at moment's notice This precaution should be observed for 24 to 72 hrs

V PRE- AND POSTOPERATIVE ORDERS FOR ADRENALECTOMY IN SECRETING ADRENOCORTICAL TUMORS

In addition to regular orders that pertain under (1 PRE- AND POSTOPERATIVE ORDERS FOR ADRENALECTOMY PHEOCHROMOCYTOMA—ADD

A Preoperative orders are essentially the same whether the Cushing's Syndrome results from adrenal hyperplasia or tumor

B Preparation for an anterior or posterior surgical approach should be made

1 Anterior flank or posterior (12th rib) approach is utilized according to specific individual indications,

a) **Thin patients lend themselves best to the anterior approach,** (especially those with pheochromocytomas who require bilateral adrenal exploration)

b) **Obese patients—especially those with Cushing's Syndrome are best operated via the posterior (12th rib) approach**

C **Precautions should be taken during and after surgery**

1 **Carefully position patient,** bony injury may result from marked osteoporosis

2 **Meticulous hemostasis, and careful closure of wound**

3 **Hypotension and rapid pulse**—at onset during and after surgery—is discussed in (I) PRE- and POSTOPERATIVE ORDERS FOR PALLIATIVE ADRENALECTOMY — under (II) IN OPERATING ROOM

D When a unilateral adrenocortical tumor is excised for Cushing s Syndrome—the opposite adrenal cortex will be atrophic Stimulation with corticotropin (ACTH) can promptly restore its anatomic integrity but owing to chronic suppression of the pituitary corticotropin production relapse may occur hence corticoid therapy must be continued for as long as required often a year or more These patients usually require more corticoid therapy than do Addisonians

E Cortical tumors causing primary Aldosteronism—have no effect

bronchus by inserting it to its full extent with the head bent first to one side and then the other

D TRACHEOTOMY

The elimination of secretions is greatly facilitated by a tracheotomy Tracheotomy is necessary in

1 All unconscious patients not under anesthesia
2 The patient who is fatigued from coughing and frequent aspirations and who cannot raise secretions which reaccumulated after bronchoscopy
3 Patients that require Respirator care
4 Tracheotomy patients should also be encouraged to cough frequently

E BRONCHOSCOPY

Bronchoscopy is a valuable procedure It enables visualization of the bronchial tree and permits accurate directing of the suction catheter It should be used in cases of persistent atelectasis and in those instances where tracheal aspiration is indicated but cannot be accomplished by the nasal route

F POSTURAL DRAINAGE

1 This is particularly helpful in patients with residual bronchiectasis or persistent atelectasis
2 It should supplement but not replace other effective methods of removing bronchial secretions

II IMMEDIATE POSTOPERATIVE CARE (1ST HOUR)

Most fatal complications occur within the first few hours after surgery It is the resident's responsibility to see that the patient's condition is satisfactory following extubation and that the chest drainage system is properly set up and functioning well

NOTES

GENERAL CONSIDERATIONS AND INSTRUCTIONS FOR THE PRE- AND POSTOPERATIVE CARE OF ALL CHEST CASES

BY

JEROME R HEAD, M D

Sr Attending Surgeon at Wesley Memorial Hospital Consultant in Thoracic Surgery at Hines Veterans Administration Hospital Attending Surgeon at Evanston Hospital Asst Professor of Surgery at Northwestern University Chicago Illinois

I THE ELIMINATION OF SECRETIONS

This central problem in postoperative chest cases requires constant conscientious attention and skill on the part of the attending, nursing and house staffs

A COUGHING

Coughing is the single most effective measure for the elimination of secretions Discomfort to the patient makes it impossible for him to cough properly in spite of his willingness to do so

1. Patient must have supervised coughing
2. Sedation must be adequate to allow coughing but not so much as to depress respiration and the cough reflex
3. Tend to under-sedate patient for the first 48 hours Avoid excess of sleeping medications
4. Do not sedate a patient who is restless from anoxemia make him cough and aspirate the trachea, P R N Oxygen may be indicated

B TRACHEAL INJECTIONS

Inject 2-3 cc of Physiological Saline Solution into the trachea between the cricoid and thyroid cartilages, this injection is useful in stimulating coughing and testing the level of cough reflex in a patient

C CATHETER ASPIRATION OF THE TRACHEA

1. Aspiration should be done in a sitting position with the head forward and the aspirator holding the patient's tongue
2. A 16 (F) hard rubber catheter is inserted through the nares and into the trachea
3. The catheter is not in the trachea if the patient can say Eee with the catheter in place
4. Do not use continuous suction while the catheter is in the trachea Intermittent suction is facilitated by the use of a glass Y connector Oxygen may also be administered through the tracheal catheter by placing the nasal oxygen catheter in the open end of the Y connector and clamping the suction tubing.
5. The tracheal catheter should be directed into each main stem

2. Aspirin—600 mg alone or with Codeine—30 mg q 4 hrs P R N
3. Penicillin—400,000 units / Streptomycin—0 5 Gm } I M q 12 hrs
4. Alveolaire aerosol inhalation q 2 hrs for 10 minutes
5. Chloral Hydrate 0 5 Gm (h s) P R N , may repeat one time if necessary for sleep
6. Therapeutic multiple vitamin capsule 1 cap t i d
7. Mineral oil or milk of magnesia 1 oz (h s) P R N

C FOLLOW-UP

1. Chest X-Ray at bedside, upright position at 8 A M on 1st postoperative day Wet reading' should be called for stat
2. C B C at 8 A M on 1st and 2nd postoperative days Reports to be phoned in stat

III SPECIAL POSTOPERATIVE ORDERS

To be utilized in addition to regular postoperative chest orders

A PNEUMONECTOMY CASES

1. Pneumothorax-Set and regular pneumothorax tray should be in patients room at all times
2. Check pressures on operated side daily until almost all of the fluid is aspirated Adjust pressures to (−2) to (−6) mm of water
3. Before inserting pneumothorax needle
   a) Auscultate each side of chest to ascertain which side had lung removed
   b) Examine chest to determine side of operative incision
   c) Ask patient which side was operated on
   d) Place needle into operated side only
4. EMERGENCY' If patient expectorates bloody fluid
   a) Call Surgical Resident stat
   b) Place patient on operated side stat Keep patient in head down position
   c) Order water-trap-bottle stat'
5. Cardiac Arrhythmias
   a) Usually due to hypoxia, best to administer intranasal oxygen
   b) Give Quinidine—if heart rate is rapid and cardiac output is impaired

B LOBECTOMY, SEGMENTAL RESECTION, WEDGE RESECTION AND EXPLORATORY THORACOTOMY CASES

1. The following equipment must be in patients room at all times
   a) Chaffin Pratt suction machine
   b) (2) Sterile 50 cc syringes (for irrigation)
   c) (2) Sterile basins

PRE- AND POSTOPERATIVE ORDERS FOR ALL CHEST PROCEDURES

I PREOPERATIVE ORDERS

A WORKUP

1. Routine admission laboratory tests, i e C B C, urinalysis and Kahn
2. **Special tests,** i e Bleeding Time Coagulation Time, and Prothrombin Time
3. E K G (Routine)
4. X-Rays of Chest, P A, lateral and oblique on the side of lesion
5. Type and cross match have 6 units of whole blood on hand at time of surgery Have donors stand by

B MANAGEMENT

1. Keep patient ambulatory if possible
2. General diet Hi protein, Hi carbohydrate and Hi caloric
3. N P O after 6 P M except water, no water after midnight
4. 2 qt warm tap water on preoperative night
5. **Prep**—Shave complete chest—from neck to groin, Surgical resident should check this preparation

C MEDICATION

1. **Chloral hydrate** 0 5 Gm (h s), repeat one time if necessary for sleep
2. **Penicillin** 400 000 units and **Streptomycin** 0 5 Gm on the preoperative night and operative morning (Check first for any drug or antibiotic sensitivity before giving)
3. **Preoperative medication** to be written by Anesthesia Dept

II POSTOPERATIVE ORDERS

A MANAGEMENT

1. Check B P Pulse and Respirations q 15 minutes until stable then q 2 hours for 24 hours then q i d for 2 days
2. Temperature readings q i d until patient is discharged (During O_2 therapy—take temperature rectally)
3. Turn patient q 2 hours
4. Have patient cough q 30 minutes until clear for first 3 waking hours q hourly thereafter for 24 hours
5. Keep Intake and Output chart for 3 days
6. **Diet**
   a) Sips of clear liquids post nausea
   b) Liquid diet—gradually stepped up to a high protein high carbohydrate and high vitamin diet as tolerated
   c) Supplementary eggnog and hi protein beverages between meals and at bedtime

B MEDICATION

1. **Demerol**—50 75 mg q 3 to 4 hours for severe pain

ORDERS FOR ESOPHAGEAL RESECTION

The preoperative treatment is aimed at reducing the incidence of infection, cardiac arrhythmia, cardiac congestive failure and renal insufficiency, while increasing the nutritional status in every way

I PREOPERATIVE ORDERS

A WORKUP

1 Complete blood count
2 Complete urinalysis
3 Blood Wasserman or Kahn
4 Blood Cevitamic Acid
5 Blood Chemistry
   a) A/G Ratio
   b) N P N and Urea
   c) Blood Potassium, Sodium and Chloride
6 Liver Function Tests
   a) Thymol Turbidity
   b) Cephalin Flocculation Test
   c) Alkaline Phosphatase
7 Prothrombin Time
8 Type and cross-match patient (have donors standing by or order 4 units of blood in bank
9 Roentgenographic studies
   a) Fluoroscopic examinations
   b) X-Rays, A-P, lateral and oblique views
10 Endoscopic Study
   a) Esophagoscopic examination
   b) Biopsy

B MEDICATION

1 Correct existing vitamin difficiencies
   a) Vitamin B Complex, 1 ampule daily
   b) Cevitamic acid 1000 mgs daily
   c) Vitamin K, 25 mg daily
2 Antiseptic mouth washes q i d
   a) Peroxide diluted ½ and ½ with water
3 Night medication Phenobarbital or Sodium Amytal (hypo)
4 Check with patient for any antibiotic sensitivity, IF NOT SENSITIVE give Combiotic
   Penicillin—600 000 Units } start 2 days preoperatively,
   Streptomycin—1 Gm } I M B I D
5 Demerol 100-125 mg } 1 hr before surgery
   Scopolamine gr 1/150 }

C MANAGEMENT

1 Fluids—I V 3000 cc daily, more on order of surgeon
   a) 2 liters of 5% dextrose in water

d) (1) liter sterile Physiological Saline Solution
e) (2) forceps in sterile holders
f) (1) water trap bottle in reserve
g) (2) Sterile Simms adaptors
h) Endotracheal suction machine and No 16 (F) sterile catheter with a Y' glass adaptor
i) Oxygen and Krasno catheter

C SPECIAL ORDERS TO NURSES AND HOUSE STAFF

1 NURSING ORDERS

a) Mark fluid level on water trap bottle daily at 7 A M
b) Insure proper functioning of Chaffin Pratt suction machine If in doubt, call Service to check it
c) Turn patient q 2 hrs and position him so that the chest tubes are always clear
d) Squeeze the chest tubes q 2 hrs and P R N to loosen clots and insure adequate drainage
e) Keep solution for instillation ready for service Streptomycin 0 5 Gm with 200,000 units of aqueous Penicillin in 10 cc of sterile water

2 ORDERS TO HOUSE STAFF

a) Connect water trap bottle to suction machine Avoid side rails when connecting tubing
b) Change water trap bottle when full
c) Irrigate chest tubes b i d and P R N with antibiotic solution (See (e) under Nursing Orders')

3 EMERGENCY If any part of drainage system is inadvertently broken do the following

a) The nurse clamps the chest tubing near the chest
b) Call Service stat!
c) The Surgical Resident prepares a water-trap bottle, use sterile water
d) Re-connect the chest tubing to drainage bottle
e) Connect drainage bottle to suction as before
f) Check the drainage system with the Service
g) Tube must be under water at all times

constant nursing, choice anesthetic and bronchoscopic aspiration are employed prophylactically and actively to prevent this complication

3 **GASTRIC COMPLICATIONS**—are difficult to avoid Vagotomy leads to gastric atony and dilatation Urecholine may be beneficially employed here

4 **EMBOLIC COMPLICATIONS**—are not rare Anticoagulants and femoral vein ligations are employed only when specific indications arise (See Venous Thrombosis and Phlebothrombosis)

A **MANAGEMENT** (Also see *Pneumonectomy Orders*)

1 **OXYGEN**—*preferably by intranasal catheter*
- a) Not usually necessary after 24 hrs , also employ P R N
- b) In a high lying lesion with a high lying anastomosis the stomach in the thorax causes circulatory and respiratory embarrassment, oxygen may be continued for several days intermittantly until readjustment of respiratory and circulatory function occurs

2 **WANGENSTEEN-LEVIN SUCTION** continued throughout operation and for 6 8 days postoperatively
- a) Avoid indwelling Levin tube over a prolonged period, pressure may interfere with healing of anastomotic site We employ tube for 6 8 days postoperatively

3 **CONTINUOUS THORACIC SUCTION**—*instituted* few hours after surgery
- a) Not over 8-10 cms of negative water suction is applied to catheter
- b) Thoracic catheters are usually removed after 48 hours by the surgeon, or by the surgical resident on order of the surgeon
  - 1) Maximum effusion of sero sanguinous fluid occurs within 24 hours
  - 2) Little drainage occurs in next 24 hrs
- c) Check catheter frequently to insure continued patency

4 **DIETARY REGIMEN**
- a) **Low sodium intake,** starts 1 week preoperatively, continues postoperatively for several weeks
  - 1) Reduces tendency to tissue edema
  - 2) Reduces tendency to pulmonary edema
- b) **Foods and Fluids**
  - 1) Parenteral route—I V fluids, Dextrose Amino Acids KCl NaCl and Vitamins for first few days
  - 2) Oral route

b) 1 liter of Physiological Saline Solution
1) Vitamins added as required
2 Whole Blood, or Plasma transfusions
3 Enema—2 qt (S S) night before surgery
4 Prep From sternal notch level to mid-thighs
5 On call to O R 15 min before scheduled surgery

II MANAGEMENT DURING SURGERY

A Before esophagus is resected empty upper esophagus by Levin tube aspiration
1 Some leave the Levin tube above anastomotic site
2 Some pass the Levin tube beyond anastomotic site

B After anastomosis is completed instill mixed antibiotic solutions about operative sites
1 30 cc into thoracic cavity and about mediastinum
2 30 cc into abdominal cavity
a) Each cc contains
10 000 units of Penicillin
0 8 Gm Streptomycin

C *Before Closure of Thoracic Incision*
1 Allow complete lung expansion at end of operation, (check again before final closure of pleural cavity)
2 A catheter is brought out through a stab wound in lower intercostal space Catheters (anteriorly and posteriorly) may be employed, anteriorly for air, and posteriorly for blood and exudates

D Special Considerations Throughout Surgery
1 Adequate oxygenation and proper blood and fluid replacement must be maintained at all times
2 Reduce reflex stimuli by avoiding undue operative trauma and by instilling 2 oz 1% aqueous solution of Novacaine about the coeliac axis
3 Minimize contamination throughout procedure
4 Avoid undue tension at anastomotic site
5 Periodic lung inflation q (15 20 minutes) Check with Anesthesiologist periodically

III **POSTOPERATIVE PROCEDURE** is most important and must be carried out in the minutest detail It is aimed at maintaining the patient and preventing the following serious complications

1 **CARDIO-VASCULAR COMPLICATIONS** must be prevented by avoiding anoxia at all times Administer intranasal oxygen (10-12 l /min) oxygen to the cardiac musculature is imperative at all times

2 **PULMONARY COMPLICATIONS**—are prevented by avoiding retention of bronchial secretions All means i e

3 Blood Na, K, Cl A/G Ratio, and CO_2 Combining Power, P R N —on order of surgeon
4 X-Rays, (Portable), P R N —on order of surgeon

NOTES

(a) 1st P O day—surgical fluids orally, 1 oz q hourly
(b) 2nd to 10th P O day—2 oz hourly
(c) Thereafter—increase fluids, may add milk
(d) Subsequently institute 6 small meals daily, soft to semi solid diet Patient will be advised against eating larger quantities of food Caloric value is more important than volume Instruct patient not to lie down after meals

c) **Early ambulation**
1) Patients are usually allowed up on 1st P O day, some must be kept in bed longer until circulatory and respiratory readjustment occurs Here leg exercises and deep breathing are stressed
2) Home in 2 3 weeks

5 **X-RAYS OF CHEST DAILY** for 4 days, use Portable X-Ray machine When lung has been expanded for over 48 hrs *remove catheter and apply air tight dressing over wound* Aspirate pleural fluid P R N

B **MEDICATION**

1 **ANTIBIOTICS**
a) Penicillin and Streptomycin given I V and intramuscularly for 5-7 days P O
1) Penicillin—1 000 000 units daily
2) Streptomycin—2 Gms daily

2 **WHOLE BLOOD OR PLASMA TRANSFUSIONS**

3 **FLUIDS**—Vitamins—Dextrose—Amino Acids (See Parenteral Feeding ')

4 **DIGITALIS OR QUINIDINE**—Given preoperatively if indicated and continued postoperatively Co operation with an Internist is recommended

5 **SYMPTOMATIC TREATMENT**—P R N , for the following complaints
a) **Pain**—Demerol Dilaudid, Methadon, etc
b) **Restlessness**—Barbiturates (Phenobarbital)
c) **Sleeplessness**—Barbiturates (Seconal Nembutal)
d) **Cough**—Codeine
e) **Urinary retention, etc** Catheterization, Urecholin
f) **Nausea**—Thorazine Dramamine Compazine, etc

C **FOLLOW UP LAB**

1 Daily blood counts (complete)
2 Daily Urinalysis (Complete) for 4 days or longer

PRE- AND POSTOPERATIVE ORDERS FOR CARDIOVASCULAR ANOMALIES

BY

BENJAMIN M GASUL, M D

Director Pediatric Cardiophysiology Dept Cook County Hospital Attend Pediatric Dept Cook County Hospital Chairman of Pediatric Dept, Presbyterian Hosp Professor of Pediatrics at Cook County Post Graduate School of Medicine Chicago, Illinois

AND

EGBERT HOWARD FELL, M D

Attend Surgeon at Cook County Hospital and Presbyterian Hospital Clin Professor of Surgery at Rush U University of Illinois Chicago Illinois

AND

ARCHER GORDON, M D, Ph D

INDICATIONS FOR SURGERY IN PATIENTS WITH CONGENITAL MALFORMATIONS OF THE HEART

I THE NONCYANOTIC TYPES

A PATENT DUCTUS ARTERIOSUS

1 Average Case

Surgery is recommended at about three years of age or older

2 Severe case with predominant left to right shunt

Surgery is urgent at any age, even in infancy.

3 Severe case with bidirectional shunt

Surgery is indicated

4 Severe case with right to left shunt only

Surgery is contraindicated

5 With Bacterial Endocarditis

Proper antibiotic treatment followed by surgery

B ATRIAL SEPTAL DEFECTS

Since the introduction of the heart lung machine, and the remarkable lowering of the surgical mortality rate following 'open cardiotomy during the past three years, we advise this method for the surgical repair of all types of atrial septal defects

1 Atrial septal defects of the ostium secundum type Open cardiotomy is advised on patients preferably over 4 to 5 years of age, especially if the heart is enlarged and the pulmonary blood flow is several times greater than that of the systemic flow Hypothermia is preferred by some surgeons

2 Patients with atrial septal defects of the ostium secundum type (usually adults) in whom pressure in the pulmonary artery is markedly elevated (over 80 90 mm Hg) and where pulmonary vascular resistance is high, should be thoroughly investi-

PHARYNGOESOPHAGEAL DIVERTICULECTOMY*

PRE- AND POSTOPERATIVE CONSIDERATIONS

'Many of the patients with esophageal diverticula are very poorly nourished It is imperative that they receive careful preoperative preparation and the necessity for immediate postoperative support is obvious Immediately preceding surgery a Levin tube is inserted into the stomach via the nasal route If it is impossible to pass a suction tube due to the tip finding its way into the diverticulum, the tube can be directed easily into the stomach during the operation We wish to assert ourselves strongly on the subject of when to begin postoperative feedings It is our belief that patients fed too early (any time before the seventh day) are more likely to develop fistulous tracts Disruption of the repaired pharyngoesophageal area may be caused if the patient is encouraged to swallow semi-solid or solid food at any early date Even liquids may cause undue stress on the loosely united wound edges

If consideration is given to parenteral feeding and to the use of the indwelling Levin tube very few patients will suffer pressure disruption of the repaired defect and their general nourishment will be maintained or improved Our patients receive their postoperative feedings via the Levin tube after intravenous fluids have been discontinued They are fed in this manner until the eighth or tenth day after which the Levin tube is removed and liquid feedings by mouth are instituted'

*1 One Stage Pharyngoesophageal Diverticulectomy Dr R.W McNealy and J.A. Glassman, Surgery, Vol. 21 No 4 Pages 470-475 April 1947
2. A Two-Stage Pharyngoesophageal Diverticulectomy Dr R.W McNealy and J A Glassman J Int Coll of Surg. Vol 12 No 2 March April 1949
3 A Supra-diaphragmatic Diverticulectomy Dr R.W McNealy and J.A. Glassman *J Int. Coll of Surg. Vol. 12 No 2 1949*

NOTES

G PULMONARY STENOSIS WITH NORMAL AORTIC ROOT

1 Average Case

If there is no limitation of exercise tolerance, if the electrocardiogram reveals mild right ventricular hypertension, and cardiac catheterization confirms the electrocardiographic finding, surgery is not indicated

2 Moderately severe or severe cases with or without shunt at the atrial level

If the pressure in the right ventricle is over 90-100 mm Hg, and if there is a right to-left shunt at the atrial level—pulmonary valvulotomy, preferably with the use of the heart-lung machine is indicated

H OTHER NONCYANOTIC TYPES—of congenital malformations of the heart in which surgery with the aid of the heart lung machine is indicated are

1 Aortic Septal Defect
2 Coronary Arteriovenous Aneurysm
3 Ruptured Aneurysm of the Sinus of Valsalva
4 Anomalous drainage of all pulmonary veins

II THE CYANOTIC TYPES

A TETRALOGY OF FALLOT

The Blalock or Pott s Operation is now recommended in only severely ill patients with marked pulmonary stenosis or atresia. Pott s Operation is preferred in those infants who do not have a right aortic arch Because of the high surgical mortality of "open cardiotomy" following the corrective procedure at the present time, we do not advise surgery in children who are getting along fairly well However, in children and adults in whom exercise tolerance is markedly limited, "open cardiotomy" is indicated

B TRICUSPID ATRESIA

Blalock or Pott's Operation is indicated unless there is an associated transposition of the great vessels

C SINGLE VENTRICLE WITH PULMONARY STENOSIS

Blalock or Pott s Operation is advised

D TRANSPOSITION OF THE GREAT VESSELS

Baffes Operation is indicated in infants and young children even though the surgical mortality is still very high

III PREOPERATIVE ORDERS

A WORKUP—(Same as in other major surgical cases)

1 Complete history and physical examination
2 Complete blood count and hematocrit
3 Urinalysis
4 Kahn or Wassermann
5 Type and cross match and hold 2-4 units of blood in bank

gated before surgery is recommended

3 In patients with atrial septal defects associated with anomalous entrance of pulmonary veins into the venae cavae or right atrium, open cardiotomy" is recommended

4 Where atrial septal defects of the ostium primum type or of the atrio ventricularis communic type exist— 'open cardiotomy" is indicated

C VENTRICULAR SEPTAL DEFECTS

1 Small defects with normal pressures in the right ventricle Surgery is not advisable at present certainly not in children under 6 to 7 years of age

2 Large defects with pressures in the right ventricle over 40-50 mm Hg with large left-to-right shunts Surgery is recommended in patients over 2 years of age

3 *Large defects with right ventricular pressures approximating* that of systemic pressure
Surgery is advised unless the shunt is predominantly right-to-left

D COARCTATION OF THE AORTA

1 Average Case
Surgery is advised in patient over 6 to 8 years of age

2 Postductal coarctation of the aorta with patent ductus arteriosus
Surgery is indicated

3 Severe case of postductal coarctation with marked cardiac enlargement, a dyspnea that does not respond to proper medical treatment
Surgery is indicated even in infancy

4 Preductal coarctation of the aorta with patent ductus arteriosus
Advisability of surgery is still debatable

E DOUBLE AORTIC ARCH AND ALLIED VASCULAR RINGS

Surgery is indicated when signs or symptoms are present even in infancy

F AORTIC STENOSIS

1 Mild Case
Surgery is not advised at present in the absence of symptoms or when the electrocardiogram is within normal limits

2 Moderately Severe or Severe Case
In the presence of symptoms or even in the absence of symptoms, if the electrocardiogram reveals definite changes of left ventricular hypertrophy and strain surgery is recommended *Either the heart lung machine or hypothermia may be em* ployed

C OPERATING ROOM MANAGEMENT

1 I V fluids—two I V 's running
 —Usually one in arm, one in leg
 —Use at least size15 needles or cut-down
 —*Start one with 5% glucose, one with isotonic saline*
 —Check blood for transfusion and place in ice box in O R

2 *Special Equipment in O R*
 a) EKG or oscilloscope—preferably connected before induction of anesthesia
 b) EEG, especially for hypothermia cases and where cross clamping of aorta is contemplated
 c) Hypothermia mattress—for hypothermia cases and also to maintain body temperature in all children
 d) Thermometer with rectal thermocouple
 e) Defibrillator-Pacemaker and sterile electrodes
 f) Drugs (On nurses stand or anesthesia table in O R)

Adrenalin	Pronestyl
Levophed	*10% calcium chloride*
Cedilanid	25% potassium citrate

 g) Two separate aspirators at operating table
 h) Graduated aspiration bottles and scales to measure blood loss accurately
 i) Equipment for measuring pressure in cardiac chambers and systemic circulation, when indicated

IV POSTOPERATIVE ORDERS

A MEDICATION

1 Usual postoperative thoracotomy orders including Antibiotics Demerol Sedation Fluids and Blood as indicated
2 Digitalis—if used preoperatively or indicated postoperatively

B MANAGEMENT

1 Children placed in oxygen tent for cooling and oxygen therapy Oxygen tent at bedside when not needed Use humidified nasal oxygen for older children and adults
2 Special 24 hours nursing service
3 Portable chest x ray EKG hematocrit and hemoglobin as soon as possible on day of surgery Repeat chest x-ray and hematocrit daily until day after all chest tubes are removed
4 For temperature of 103° F or over use aspirin, cooling measures, or hypothermia mattress when indicated
5 Usual management of water seal bottles—remove as soon as there is no further drainage of air or fluid and chest x-rays reveal re-expansion of lungs and evacuation of fluid from chest
6 Suction apparatus at bedside Sterile catheters for oropharyngeal and tracheal aspiration

6 Electrocardiograms, serial studies
7 **SPECIAL STUDIES**—where indicated and available
  a) Chest x-rays, including obliques, barium swallow and special views as needed
  b) Fluoroscopy
  c) Cardiac catheterization
  d) Angiocardiography
  e) *Phonocardiography*
  f) Blood volume studies

B **MEDICATION**
1 **Digitalis**—for decompensation, pulmonary congestion or low cardiac reserve, (work closely with cardiologist)
2 **Fluids**—special precautions to prevent dehydration and thrombosis
  a) **Adults**—2500 to 3500 cc daily (on order of surgeon)
  b) Children—(keep cyanotic polycythemic child well hydrated)

	Rule for Approximate Daily Fluid Requirements
0 6 yrs —100 cc/Kgm body wt	
6-12 yrs —75 cc/Kgm body wt	
12-adult—50 cc/Kgm body wt	

  c) Day before surgery allow normal daily amounts
  d) Night before surgery
     Adults—No fluids by mouth after midnight
     Children—Oral fluids up to 2 a m for 8 a m surgery
     Employ I V fluids if additional hydration is required
  e) Fluids during surgery
     1) Principally 5% glucose in water
     2) Isotonic Physiological Saline Solution used to precede and flush blood tubing
  f) Blood and Plasma
     Replace measured blood loss
     Avoid excessive blood administration in all cases, especially in conditions with large left-to right shunts and/or low cardiac reserve
     In cyanotic patients with polycythemia use plasma for part of blood replacement
3 **Antibiotics**—Appropriate drugs and dosage to treat persistent respiratory infections residual activity (rheumatic) etc
4 **Preoperative sedation**
  a) Adequate sedation at bedtime Barbiturates
  b) Sedative and analgesic drugs on—morning of surgery as recommended by anesthetist dosage based on age weight and presence or absence of cyanosis Avoid excessive sedation in cyanotic cases

ORDERS FOR OPERATIONS ON KIDNEY AND URETER CASES*

BY

VINCENT J O'CONOR, M D

Professor and Chairman of Department of Urology at Northwestern University Chairman of Department of Urology at Wesley Memorial Hospital Chicago Illinois

I PREOPERATIVE PROCEDURE

A WORK UP

1 Careful history and physical examination Special emphasis on
   a) Type of lumbar or abdominal pain or distress
   b) Radiation of pain to back, abdomen, groin, scrotum, vulva or thigh
   c) Frequency and function of bladder emptying
   d) Physical character of voided urine, i e clear, cloudy, "port-wine", "coffee-ground"
   e) Is bloody urine seen as initial, total or terminal?
2 Complete blood count
3 Complete urinalysis
4 Kahn or Wassermann
5 Type blood and cross match, be sure proper amount of blood is on hand before surgery
6 Total blood protein, A/G ratio Routine in older individuals
7 Blood sugar
8 Blood NPN
9 Blood urea and creatinine
10 X-rays as indicated (kidney, ureter and bladder)
   a) Flat (' scout') film of K-U-B regions
   b) Excretion urograms, usually intravenous, in infants sometimes intramuscular
   c) Cystoscopy and retrograde pyelograms
   d) Chest films are indicated in all patients suspect of renal or retroperitoneal neoplasm
   e) In the case of kidney or ureteral stones, always take a flat film just before placing the patient on the operating table the stone may have changed location since previous film was taken
11 Urine cultures

*The same orders will apply to other operative procedures done through a flank, or so-called lumbar incision i.e lumbar sympathectomy retroperitoneal enlargements or tumors

7 Change position and cough patient frequently Encourage deep breathing and leg exercises
8 Blood pressure readings q ½ hr for 8 hrs, then q 1 hr for 8 hrs, then q 3 hrs for 8 hrs
9 Maintain oral hygiene—allow patient to rinse mouth frequently during first 24 hours

NOTES

ORDERS FOR OPERATIONS ON KIDNEY AND URETER CASES*

BY

VINCENT J O'CONOR, M D

Professor and Chairman of Department of Urology at Northwestern University Chairman of Department of Urology at Wesley Memorial Hospital, Chicago, Illinois

I PREOPERATIVE PROCEDURE

A WORK UP

1 Careful history and physical examination Special emphasis on
   a) Type of lumbar or abdominal pain or distress
   b) Radiation of pain to back, abdomen, groin, scrotum, vulva or thigh
   c) Frequency and function of bladder emptying
   d) Physical character of voided urine, i e clear, cloudy, 'port-wine", "coffee-ground"
   e) Is bloody urine seen as initial, total or terminal?
2 Complete blood count
3 Complete urinalysis
4 Kahn or Wassermann
5 Type blood and cross match, be sure proper amount of blood is on hand before surgery
6 Total blood protein, A/G ratio Routine in older individuals
7 Blood sugar
8 Blood NPN
9 Blood urea and creatinine
10 X-rays as indicated (kidney ureter and bladder)
   a) Flat (scout) film of K-U-B regions
   b) Excretion urograms, usually intravenous, in infants sometimes intramuscular
   c) Cystoscopy and retrograde pyelograms
   d) Chest films are indicated in all patients suspect of renal or retroperitoneal neoplasm
   e) In the case of kidney or ureteral stones, always take a flat film just before placing the patient on the operating table the stone may have changed location since previous film was taken
11 Urine cultures

*The same orders will apply to other operative procedures done through a flank, or so-called lumbar incision i.e lumbar sympathectomy retroperitoneal enlargements or tumors

a) Clean voided specimen in male } Take urine under strict
b) Catheter-specimen in female } sterile precautions!
c) Culture and sensitivity tests—if positive for microorganisms

12 Guina pig innoculation if at all suspicious of renal tuberculosis
13 Phenolsulphonphthalein excretion test
14 In all patients with urinary tract calculi order fasting blood **calcium, phosphorus** and **uric acid** determinations Urinary calcium excretion tests are indicated in selected patients, especially those with recurrent stones
15 *Special tests when indicated*
   a) In suspect hypertension-producing adrenal tumor (pheochromocytoma)
      1) **Benzodioxan** studies—Benodaine (Merck) I V is adrenolytic, i e Benodaine will produce a brief but significant drop in blood pressure when hypertension is due to a pheochromocytoma No change, or only a moderate and transient drop of blood pressure will occur in a hypertensive patient without this tumor
      2) Quantitative excretion of **Norepinephrine** in the urine is now the most exact positive test for the presence of a pheochromocytoma Excessive amounts of this substance will be found in almost every patient with pheochromocytoma

B MEDICATION

1 Insure a good night s sleep preoperatively by giving Seconal gr 1½ to 3 at 10 P M
2 If indicated preoperative **antibiotics** may be given, but only if urinary infection has been proven by culture In case drainage tubes are to be left in the kidney, kidney pelvis or ureter after the surgical procedure **it may be rational to start antibiotic therapy before surgery** Ordinarily we prefer to wait until after surgery before beginning antibiotic therapy
   a) Penicillin
   b) Streptomycin or dihydrostreptomycin
   c) Aureomycin
   d) Chloromycetin
   e) Terramycin
   f) Achromycin
   g) **Neomycin** and **Aerosporin** to be used only in desperate situations because of their profound **ototoxic** and **nephrotoxic** effects
3 Sulfonamides (alone or in conjunction with antibiotics)

a) Sulfadiazine
b) Sulfathiazole } 'Triple Sulfas"
c) Sulfamerazine
d) Gantrisin"—Azo-Gantrisin

4 Antiseptic mouth washes as indicated

5 Morphine gr 1/6
Scopolamine gr 1/150 } 1 hr before surgery
(Demerol 50 to 100 mg may be employed in place of morphine)

6 Consult Department of Anesthesia regarding preoperative medication and type of anesthesia to be employed

C MANAGEMENT

1 Anesthetist or intern to start I V Physiological Saline Solution or 5% dextrose in Ringer's, etc , according to individual indication Blood to be supplemented later only if blood loss justifies replacement

2 Position on table for renal or upper ureter lumbar incision

a) Patient is placed on side with kidney Elevator between rib cage and crest of ilium, leg on side of incision straight, the under leg flexed as much as possible Long, broad, 4-inch adhesive strips fastened to sides of table and drawn across the body over the 8th rib and below the iliac crest to keep patient in fixed position Special arm-holder or the arm on the side of the incision is useful in getting good position and preventing any pressure complications

III POSTOPERATIVE PROCEDURE

A MANAGEMENT

1 Turn patient on non operated side
2 Slight elevation of back rest is permitted
3 B P pulse and respirations are recorded q 30 minutes until stabilized thereafter q i d for next 48 hours (If B P drops to 80 or below, notify intern or resident stat!)
4 Change position of patient q hourly
Encourage leg exercises and deep breathing
Encourage coughing q hourly for 10 minutes
5 Oxygen (intranasally) P R N , (4-10 liters/minute)
6 Record fluid intake and output chart
7 Catheterize patient q 10 hrs or at anytime for distress, P R N
8 Rectal tube q i d for 30 minutes also P R N

B MEDICATION

1 Morphine sulphate gr 1/6 for pain or restlessness, ordered by surgeon only (Demerol 50 mg may be employed instead)

2 Antiseptic mouth washes t i d
3 Parenteral fluids
   a) 3000 cc for first 24 hours after surgery (See "Use of Parenteral Fluids')
4 Oral administration of water is started 24 hours after surgery (unless contraindicated) at rate of 1 oz q hourly in teaspoonful amounts Gradually step up to "Surgical Liquids' as tolerated
5 *Mineral oil (or plain Petrogaler) 1 oz q nightly*
6 Chemotherapy—(See 'Preoperative Orders' and 'Antibiotics"

C **FOLLOW UP LAB**
1 Daily urinalysis until stopped Intake and output charted
2 Complete blood counts on 3rd, 6th and 9th P O days
3 N P N and Creatinine on 3rd P O day and P R N

NOTES

URINALYSIS—(Normal Values)

Gm /1000 cc —approximate 24 hr excretion (or as noted)
Specific gravity 1 003—1 030
pH 6 (4 7—8 0)
Volume 1200 (600 2500) cc /24 hr
Night vol /Day vol = 1 2 to 1 4
Night urine—less than 700 cc Sp gr greater than 1 018
Total solids 55—70 Gm

Ascorbic acid	15 — 50 mg
Ammonia	0 3 — 1 0 (N 0 4)
Amino acids	0 2 — 0 4
Arsenic	0 05 mg or less
Calcium	0 1 — 0 3
Chlorides as NaCl	9 — 16
Creatine	0 — 0 06
Creatinine	1 0 — 1 8
Diastase	1 4 — 1 16
Hippuric acid	0 1 — 1 0
Iodine	50 — 250 gamma
Iron	0 1 — 0 2
Ketones	0 3 — 1 0
17 Ketosteroids Males	8 — 21 mg
17 Ketosteroids Females	4 — 14 mg
Lactic acid	0 2 — 0 8
Lead	50 gamma or less
Magnesium	0 05— 0 20
Nicotinic acid	3 — 10 mg
Phenols	0 1 — 0 3
Phosphorus	0 09— 0 11
Porphyrins	0— 30 gamma
Potassium	1 5 —2 5
Protein (albumin)	0— 0 1
Purines	0 05
Riboflavin	0 5 — 0 8 mg
Serotonin	(negative)
Sodium	4
Sulfur	1 — 2
Thiamine	0 030—0 300 mg
Urea	25—35 (N 10 12)
Uric acid	0 5 —0 8 (N 0 2)
Urobilinogen	0—4 mg

CEREBROSPINAL FLUID (Normal Values)

	(Lumbar Puncture)
Amount (adults)	100—140 cc
Appearance	Clear colorless
Pressure (on side) Newborn	30—80 mm H_2O
Pressure (on side) Children	50—100 mm H_2O
Pressure (on side) Adults	70—200 mm H_2O
Specific Gravity	1 003 — 1 009
pH	7 35 — 7 40
Total cell count, Infants	0 — 20 per cu mm
Total cell count, Adults	0 — 10 per cu mm
Proteins, total	20 — 45 mg %
Proteins, globulin	4 — 10 mg %
Proteins, albumin	16 — 35 mg %
Glucose	40 — 80 mg %
Chlorides as NaCl	690 — 750 mg %
CO_2—combining power	40 — 60 vol %
Cholesterol	0 05 — 0 20 mg %

NOTES

TABLE OF NORMAL LABORATORY VALUES

Test	Normal Value
Acid Phosphatase	0 1 unit (Bodansky)
Albumin—Globulin Ratio	$\frac{A}{G} = \frac{2}{1}$ or $\frac{4\ 5\ \text{Gms}/100\ \text{cc.}}{2\ 0\ \text{Gms}/100\ \text{cc.}}$ or 2 1
Alkaline Phosphatase	Adults 1 5-4 units (Bodansky) Children 5 12 units (Bodansky)
Amylase (blood)	60-200 Somogyi units
Bilirubin (serum)	1 2 mg /1000 cc (0 1-0 2 mg.%)
Blood gases	
A. Arterial Blood	
1 Oxygen content	16-20 vol %
2. Oxygen capacity	95 100%
B Venous Blood	
1 Oxygen content	11 17 vol %
2. Oxygen capacity	35 60%
Blood differential count	
R B C.	4 5 5 000 000/cu.mm
Neutrophiles	5 9 000/cu mm.
Lymphocytes	25 30%
Monocytes	4 8%
Eosinophiles	0 5-4%
Basophiles	0-1 5%
Reticulocytes	0 2%
Platelets	125 300 000/cu mm
Blood—(Special Tests)	
Hemoglobin (Hb)	
Male 14 18 Gms /100 cc	
Female 12 16 Gms./100 cc	
Hematocrit (Volume of packed cells)	
Male 40 50%	
Female 37-47%	
Coagulation Time (Lee White) Venous	2 10 minutes
Capillary Fragility Tests	10 15 petechiae per square inch on forearm after blood pressure cuff is filled to 90 mm
Bleeding Time	Duke—1 3 min Ivy—2-4 min.
Clot Retractability (Blood)	Complete in 1 2 hrs.
Specific Gravity (Blood)	1 0254 1 0288
Blood Volume	
Adults	3000 7000 cc
Male	45 85 cc /kgm body wt
Female	65 100 cc /kgm body wt

BONE MARROW CYTOLOGY

Cell	Value
A Granulopoietic Series	
Myeloblasts	0 3 5%
Promyelocytes	1 8%
Myelocytes	
a) Neutrophilic	5 19%
b) Eosinophilic	0 5 3%
c) Basophilic	0 0 5%

Metamyelocytes	13 32%
Polymorphonuclear Neutrophiles	7 30%
Eosinophiles	0 5-4%
Basophiles	0 0 7%
Lymphocytes	3 17%
Plasma cells	0 2%
Monocytes	0 5 5%
Reticulum cells	0 2 2%
Megakaryocytes	0 05 3%
B Erythropoietic Series	
Pronormoblasts	1 8%
Normoblasts (Acidophilic basophilic and polychromatic	7 32%
Megaloblasts—(non nucleated R B C vary in numbers)	
Bromsulphalein (5 mg /kgm)	No dye after 45 minutes
Calcium (serum)	4 5 5 5 mEq /Liter 9 11 mg /100 cc
Carotinoids—(serum)	100 300 I V /100 cc
Cephalin Cholesterol Flocculation	0
CO_2 Combining Power (plasma)	
Adults	50 60 vol %
Children	40 50 vol %
Chlorides (plasma)	585 645 mg NaCl/100 cc 100 110 mEq /Liter (chloride)
Cholesterol (plasma)—Total	150 250 mg /100 cc
Esters	50 75% of total
Cevitamic acid	0 7 1 4 mg /100 cc
Clot retractability (blood)	complete in 1 2 hrs
Coagulation Time (Venous blood)	6 10 minutes
Creatinine (blood)	1 2 mg /100 cc
Congo Red Test (blood)	More than 70% of dye in blood after 30 min
Fragility Test (**R B C**)	
Minimum	0 42% NaCl Sol
Maximum	0 32% NaCl Sol
Galactose Tolerance Test	
Dose	40 Gms Galactose
Less than 3 Gms excreted in 5 hours	
Glucose Tolerance Test	*100 Gms Glucose by mouth*
Standard	Blood sugar at end of ½ hr rises to not more than 180 mg /100 cc Normal blood sugar at end of 2 hrs with no sugar in urine
Glutamine (plasma or serum)	0 2 mg %
Hemoglobin	
Women	14 5 Gms
Men	*15 0 Gms*
Hematocrit	45% (children higher %) (adult females lower %)
Hippuric Acid Test	
Oral	6 Gms Benzoic acid 4 6 Gms of Hippuric acid excreted in 4 hrs.
I V	0 7 1 5 Gm Hippuric acid excreted in 1 hr

Insulin Tolerance Test (0 1 unit/kgm body wt I V)	Glucose drops to ½ fasting level in ½ hr Returns to normal (fasting level) within 2 hrs.
Iodine (P B I, Hormonal iodine)	3 5 6 0 microgram %
Icteric Index	4 6 units
Iron (blood)	46 55 mg %
Iron (serum)	80 170 micrograms %
Lipase (blood)	0 2 1 5 units
Lipids (plasma) total	570 820 mg %
Lipids (plasma) fatty acids	190-420 mg %
Lipids (plasma) phosphatides	170 830 mg. %
Magnesium (serum)	1 6 2 5 mEq /Liter 1 8 3 6 mg %
N.P.N (Non Protein Nitrogen)	20-40 mg %
Phenolsulphonphthalein Excretion (urine)	40 60% excreted in 1 hr 60 85% excreted in 2 hrs
Phospholipids (as Lecithin)	150 350 mg %
Phosphorus (Lipid Phosphorus)	6-14 mg. %
Phosphorus (Total)	
Adults	8 18 mg %
Children	5 14 mg %
Phosphatase (serum) acid	0 1 (Bodansky) unit
Alkaline	1 5 (Bodansky) units
Potassium (serum)	16 22 mg /100 cc. 5 mEq/Liter
Platelets (blood)	125 000 300 000/cu mm
Plasma Lipoids (blood) Total	570-820 mg %
Neutral fat	0 200 mg %
Total fatty acids	180-420 mg %
Proteins (Blood)—	
Total	6 5 7 5 Gms /100 cc
Albumin	3 8-4 4 Gms./100 cc
Globulin	2 2 3 4 Gms /100 cc
A/G Ratio	2 1
Alpha (1) Globulin	0 124 0 425 Gm /100 cc
Alpha (2) Globulin	0 43 0 93 Gm /100 cc
Beta Globulin	0 49 1 19 Gm /100 cc
Gamma Globulin	0 55 1 78 Gm /100 cc
Fibrinogen	0 2 0 6 Gm /100 cc
Prothrombin Time (Quick Method)	12 14 seconds
Pyruvic acid (Blood)	0 7 1 2 mg %
Sedimentation Rate	
Men	Approx 0 10 mm /hr
Women	Approx 0 20 mm /hr
Sodium (serum)	135 150 mEq /Liter 310 350 mg /100 cc
Sugar (glucose) (blood)	80 110 mg /100 cc
Takata Ara Test	(negative)
Thymol Turbidity	0 2 units
Transaminase (SGO T)	8-40 units
Urea (blood)	10 15 mg /100 cc

Urea Clearance	40 cc or more blood cleared per minute if urine volume is less *than 2 cc per minute*
Uric acid (blood)	2 5 mg /100 cc
(urine)	0 75—1 Gm /24 hrs
Urobilinogen	
(urine)	0-4 mg /24 hrs
(feces)	40 300 mg /24 hrs
17 Ketosteroids	
Males	8 20 mg excreted in urine/24 hrs
Females	4 15 mg excreted in urine/24 hrs

Vitamins

A—(serum) 40 60 gamma%
B—(serum Thiamine)—3 5-4 2 gamma %
C—(cevitamic acid) 0 4 1 4 mg %
E—(Alpha Tocopherol)—0 8 1 2 gamma %
Riboflavin—(Blood)—35-45 gamma %

INDEX